

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard		1	2	3		4
A01 = Structure of microcard					SIS	
B01 = Trouble-shooting chart	-A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	-B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	-F-	XXXXX	XXXXX	XXXXX	XXX	
	-G-	XXXXX	XXXXX	XXXX		
	-H-					
	-J-					
	-K-					
	-L-					
	-M-					
N01 = Service information	-N-	*XXXX	XXXXX	XXXXX	XXX	*X XX*
		12345	67890	12345	67890	12345 678
			1		2	
						Index






N28 = Table of contents and publication information

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Testers and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

			
Beginning	Mid-section	End	One-page section
A01			

HOW TO USE THE MICROCARD

Trouble-shooting instructions for
System: LH 2.4 - JETRONIC
Descriptions, photographs, terminal designations and special features refer to vehicle:

VOLVO 740
2,3 l/ 4 Zyl.- Mot. 11.87->

These basic instructions are comprehensive trouble-shooting instructions. They must not be used as vehicle-specific instructions. Caution! Descriptions and photographs may deviate from the vehicle-specific brief instructions.

Mandatory set values, terminal assignments and special features should be taken from the vehicle-specific brief instructions only. For brief instructions, see table of contents Microcard KFZ-00..

A02		
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SPECIAL FEATURES

- * LH 2.4 - Jetronic with self-diagnosis and flashing-code output.
- * 35-pole control unit.
- * Fault lamp in instrument panel.
- * Lambda closed-loop control with adaptive basic matching.
- * Idle-speed regulation with single-winding rotary actuator.
- * Tank ventilation system with controlled tank ventilation valve.

SPECIAL FEATURES (CONTINUED)

Lambda closed-loop control with adaptive basic matching:

The LH 2.4-Jetronic is a system with learning capability, i.e. changes in ambient conditions, which adaptively affect mixture preparation under certain operating conditions, are recognised and automatic compensation is provided.

The following are some examples of possible changes in ambient conditions:

- * Change in air density (high altitude).
- * Changes in quality (e.g. alcohol content) of fuel.
- * Leakage air in intake system.
- * Changes in engine and fuel-induction system with increasing service life (drift).

Following repairs, e.g. elimination of pronounced leakage air, a situation may therefore be encountered where the engine temporarily exhibits unfavourable running behavior after starting, with this behavior then becoming normal again after a brief period or possibly following a short drive under load.

SPECIAL FEATURES (CONTINUED)

Tank ventilation system:

The fuel vapors occurring in the fuel tank are stored in an active-carbon filter. When the engine is running, it sucks off the fuel vapors. A pulsed tank ventilation valve, which is installed between the active-carbon filter and the intake manifold, meters the fuel vapors supplied.

The variable on/off ratio is output by the control unit as a function of the engine operating status and thus determines the opening cross-section of the tank ventilation valve. An excessive change in mixture is therefore avoided.

SPECIAL FEATURES (CONTINUED)

Self-diagnosis:

Self-diagnosis is effected by way of a flashing code. For this purpose an indicator lamp (LED) is provided in the diagnosis unit on the left-hand spring-strut dome.

Activation of diagnosis: insert lead on diagnosis unit into socket 2. Button must be pressed for a certain period of time.

Faults occurring when driving are stored in the fault memory of the control unit. Exhaust-gas faults and faults relevant to safety (carb faults) are continuously indicated when they occur by the check-engine lamp.

The fault memory must be cleared once all faults have been eliminated.

The faults remain stored even when the ignition has been switched off.

SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

For testing of compressions pressure, disconnect pump relay in order to prevent undesired injecting of the injection valves.

Do not short-circuit ignition coil term. 1 to ground (e.g. for switching off the engine). Ignition coil and possibly control unit will be destroyed.

Never connect positive pole of battery to ignition coil term. 1. Control unit will be destroyed.

If installing an alarm system, follow installation instructions for L-Jetronic vehicles or SIS microcard PKW 012. Make sure that the alarm relay is not disturbed by external fields (e.g. from ignition leads), thus incorrectly triggering.

SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

Never start engine without battery securely connected (battery terminals tightened). Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine.

Provide starting assistance only with second 12 V battery and jump leads.

Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or providing starting assistance, follow the operating instructions for the fast charger as well as instructions of the vehicle manufacturer.

Disconnect battery from vehicle electrical system before charging or fast-charging.

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of a control unit.

Do not connect or disconnect wiring-harness plugs from control units or trigger boxes with the ignition on.

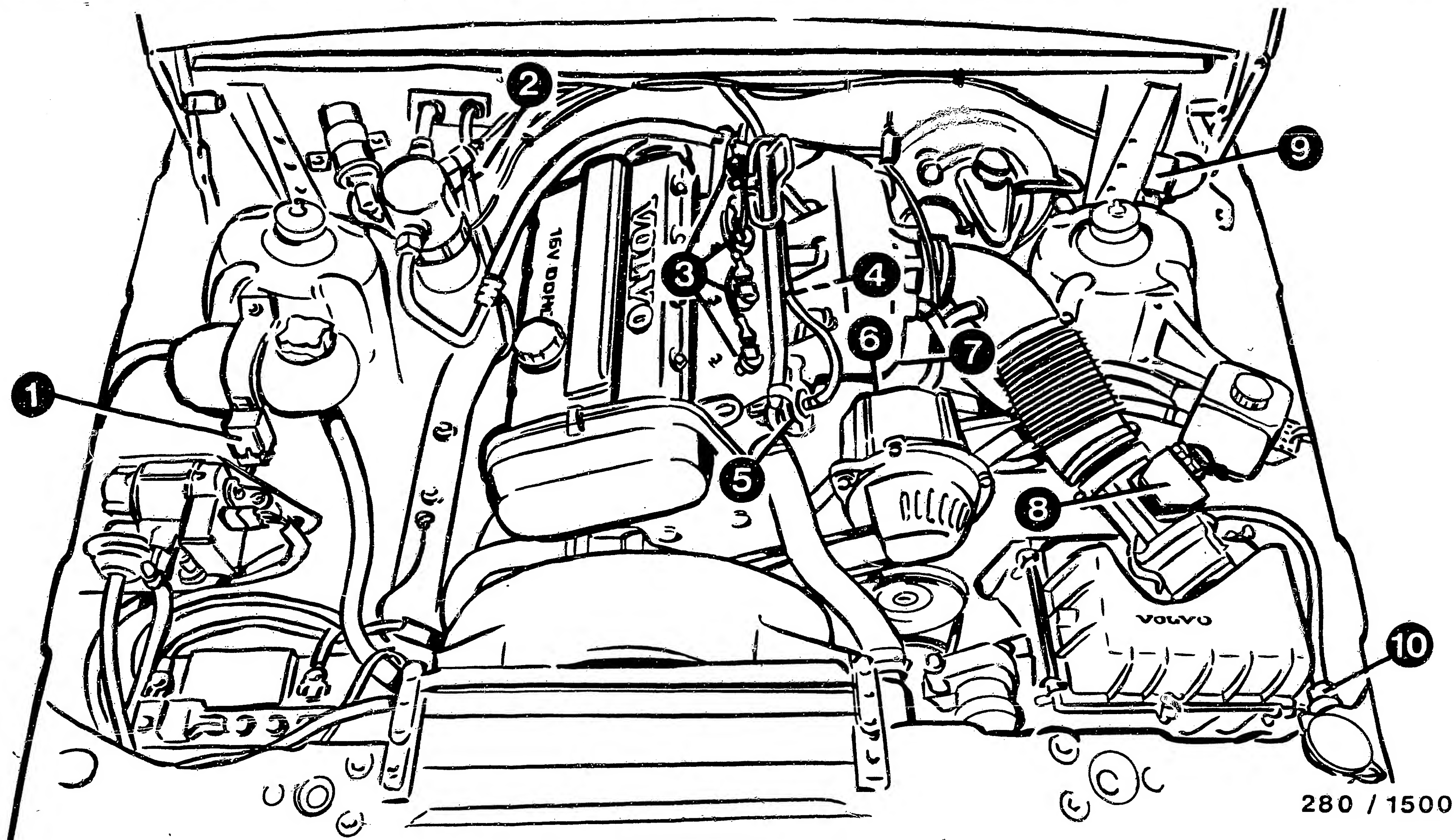
Remove control units at temperatures above + 80° C (paint-drying installation).

Remove control units before carrying out electric welding work.

Name	Designation	Part no.
Motortester e.g.	MOT 201	0 684 000 201
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Test lead		1 684 463 093
Exhaust-gas analyzer e.g.	ETT 008.00	0 684 100 800
	ETT 008.04	0 684 100 804
	ETT 008.05	0 684 100 805
Digital multimeter	MMD 301	0 684 500 301
	Fluke	75 or 77
Pressure measuring device For testing all fuel pressures and for performing system leak test.		KDJE-P 100
Three-way line		KDJE-P 100/13
Connection part	KDJE-P100/14 or	KDJE-P 100/16
Set of parts for solenoid-operated injection valve and pressure regulator		1 287 010 704
Mounting paste	VS 14016 Ft 120g	5 964 080 112
For fitting lambda sensor	450g	5 964 080 145
Vacuum hand pump	commercially available e.g. Mityvac Pump Korinth Ludwig-Kloos-Str. 21 D-6450 Hanau 7	
Sleeve-type suppressor 5 k Ω		0 356 500 001
Temperature sensor		0 280 130 028
Test leads (for proper connection of testers to connectors).		KDZS 0004 KDUM 0008
1 battery 1.5 V (unicell) For simulation of lambda-sensor voltage.	commercially available	

A09	—	=> <=
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[illegible]



- 1 = Auxiliary relay
- 2 = to lambda-sensor plug connection
- 3 = Solenoid-operated injection valves

- 4 = Ground terminal
- 5 = Pressure regulator
- 6 = to temperature sensor (engine)
- 7 = to idle actuator

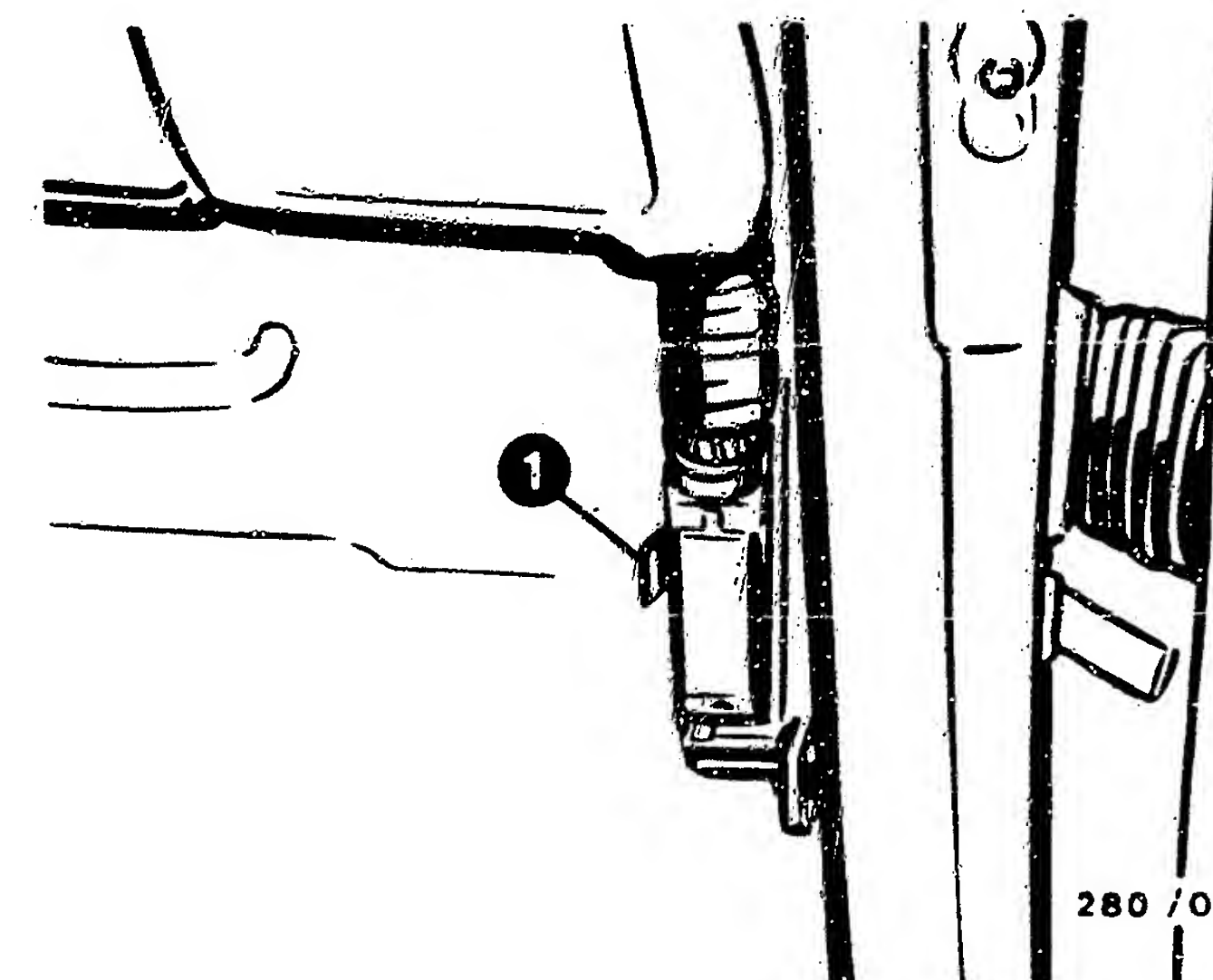
- 8 = Hot-wire air-mass meter
- 9 = Diagnosis unit
- 10 = Tank ventilation valve

INSTALLATION POSITION OF COMPONENTS

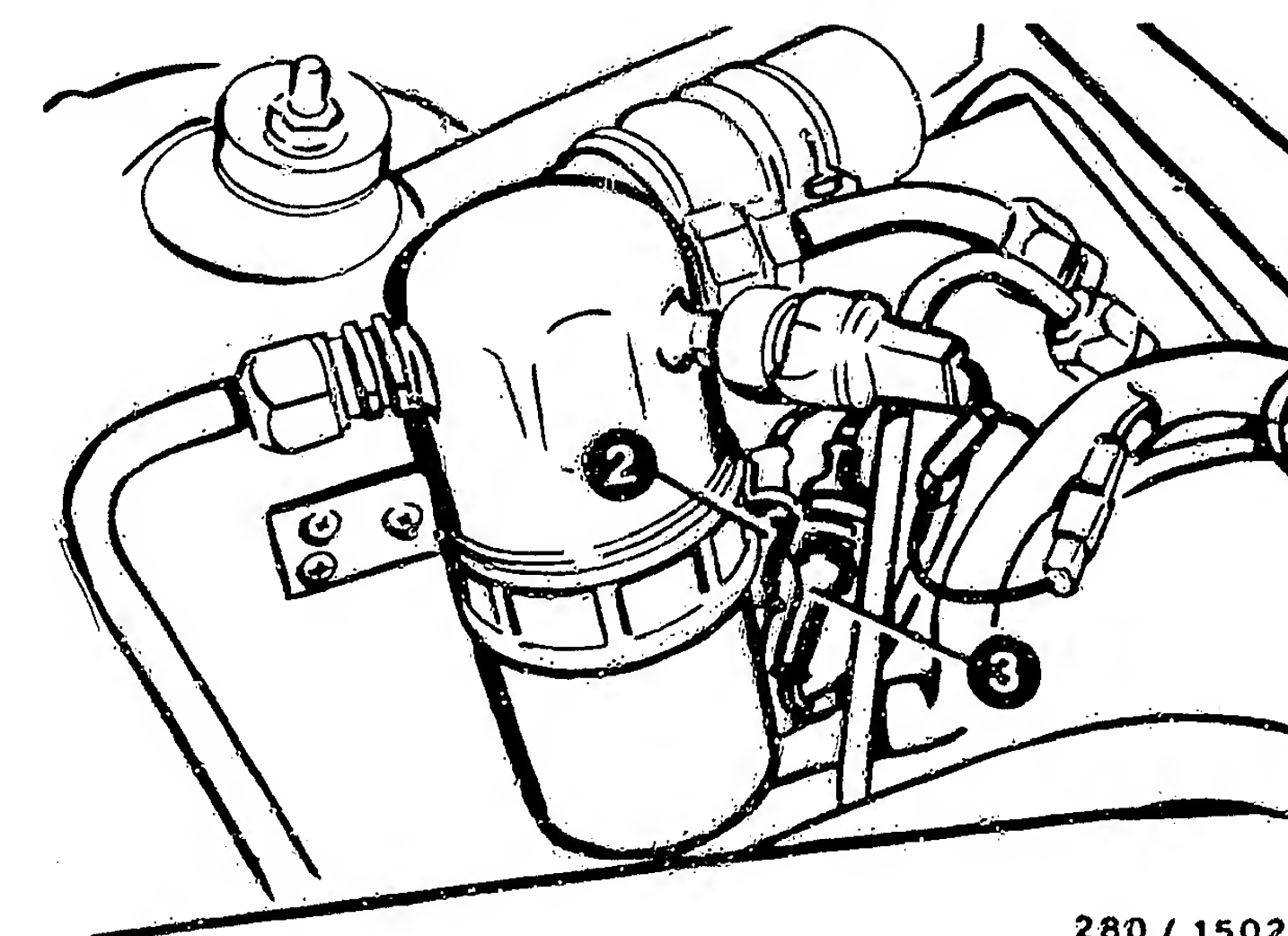
INSTALLATION POSITION OF COMPONENTS (continued)

- 1 = Control unit
- 2 = Lambda-sensor plug connection
- 3 = Lambda-sensor-heater plug connection
- 4 = Tank ventilation valve

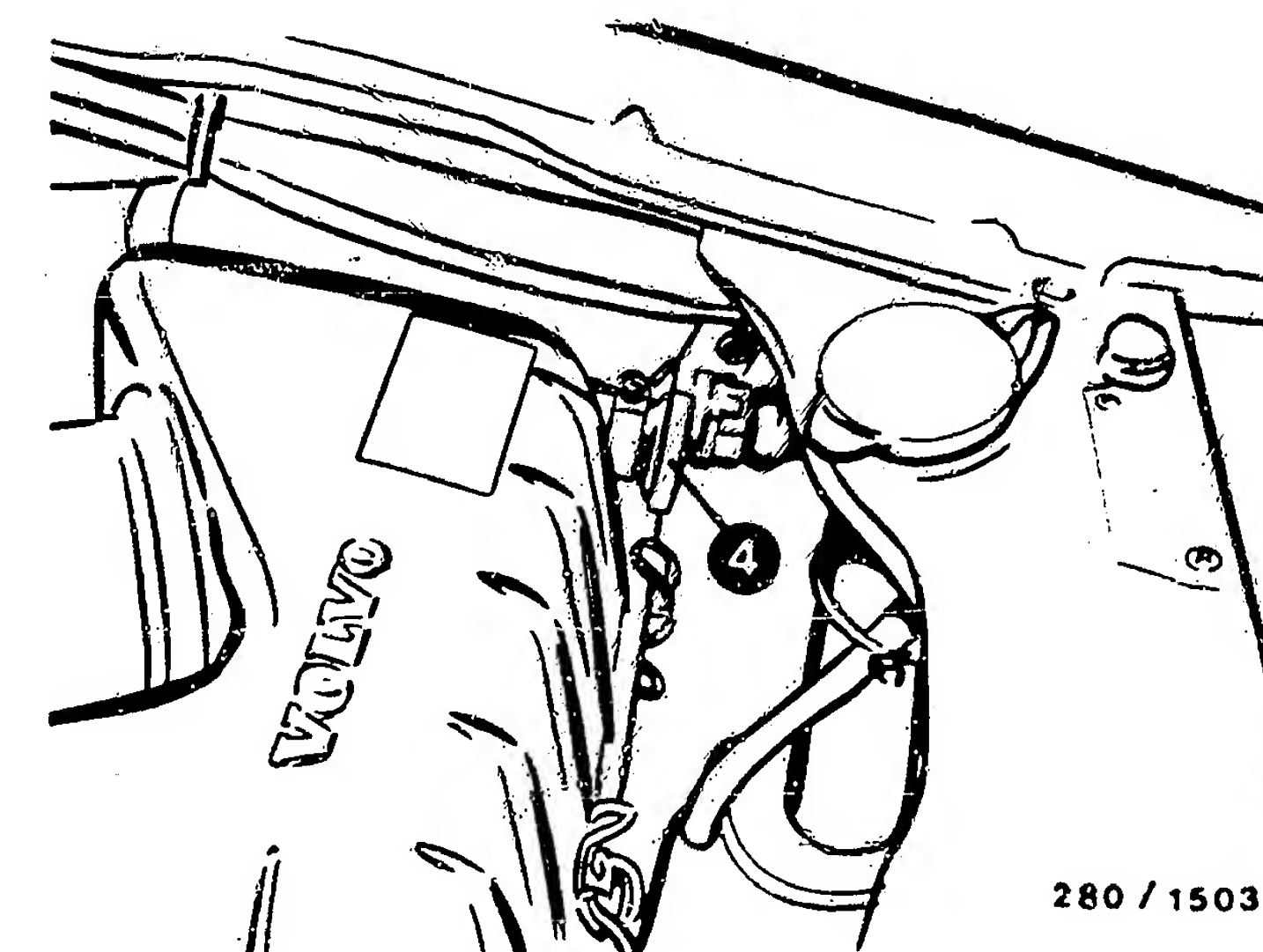
The control unit is located behind a cover on the right-hand side in the front passenger's footwell.
The pump fuse, main relay and pump relay are located in the passenger-compartment center console behind the ashtray.



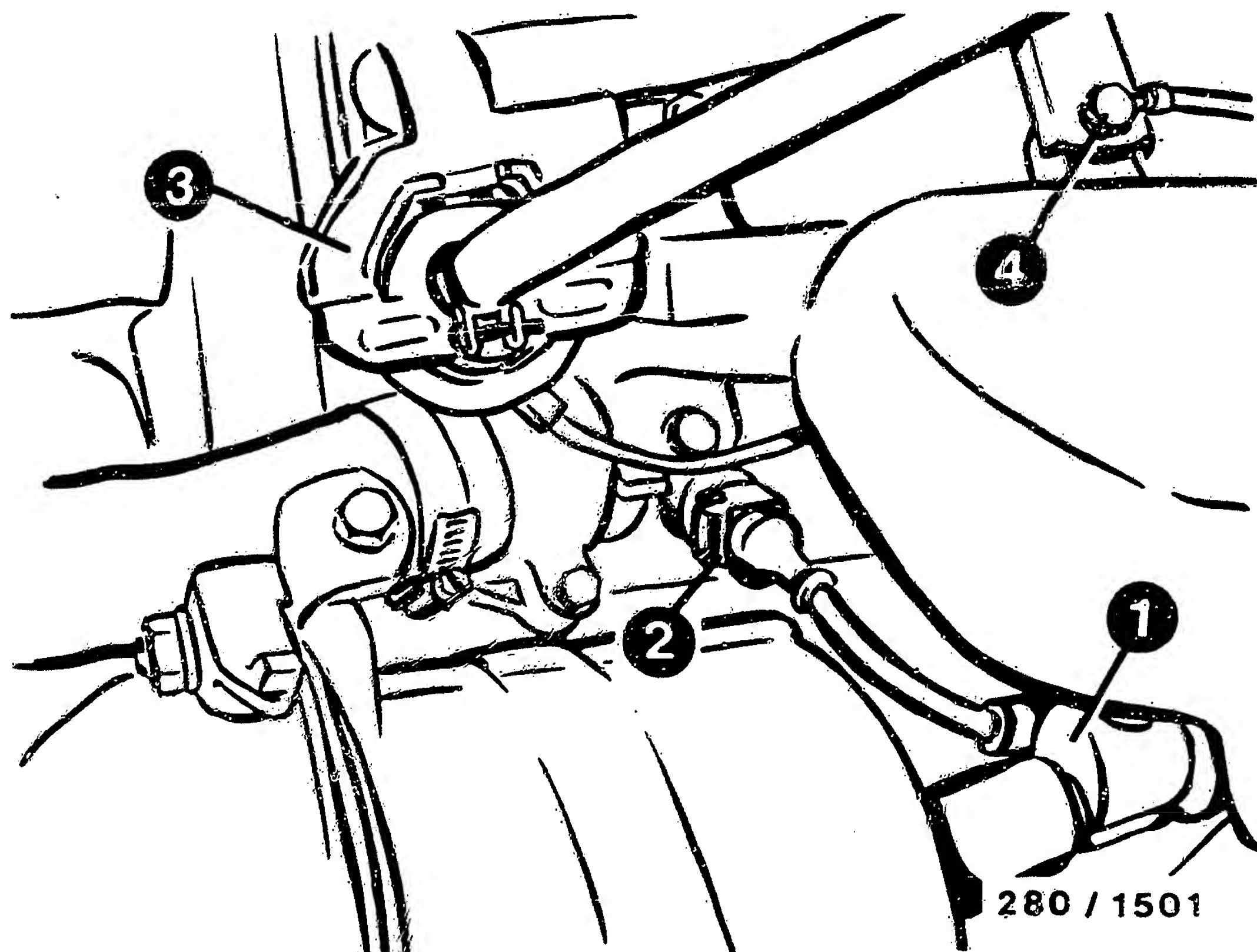
280 / 0805



280 / 1502

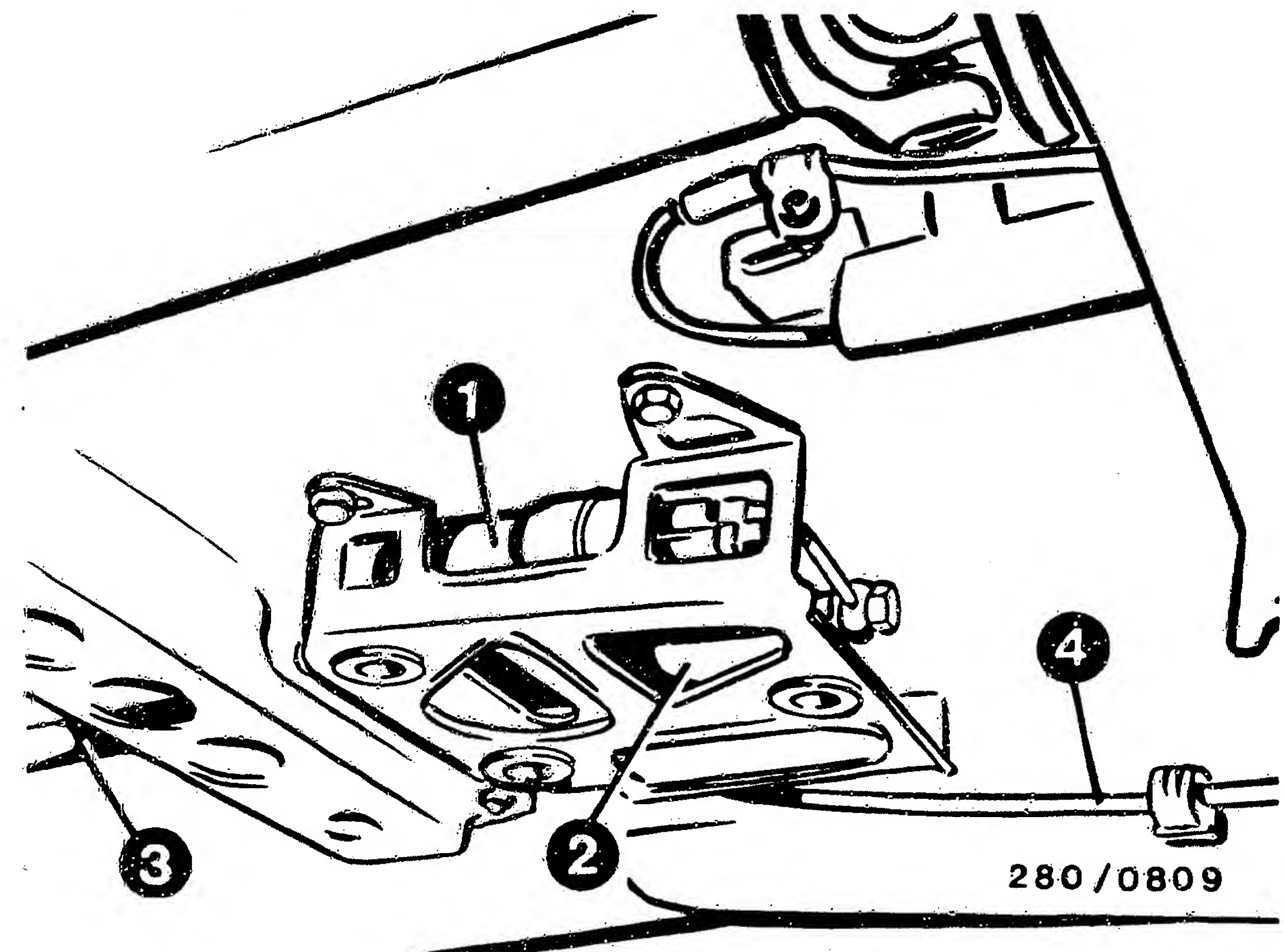


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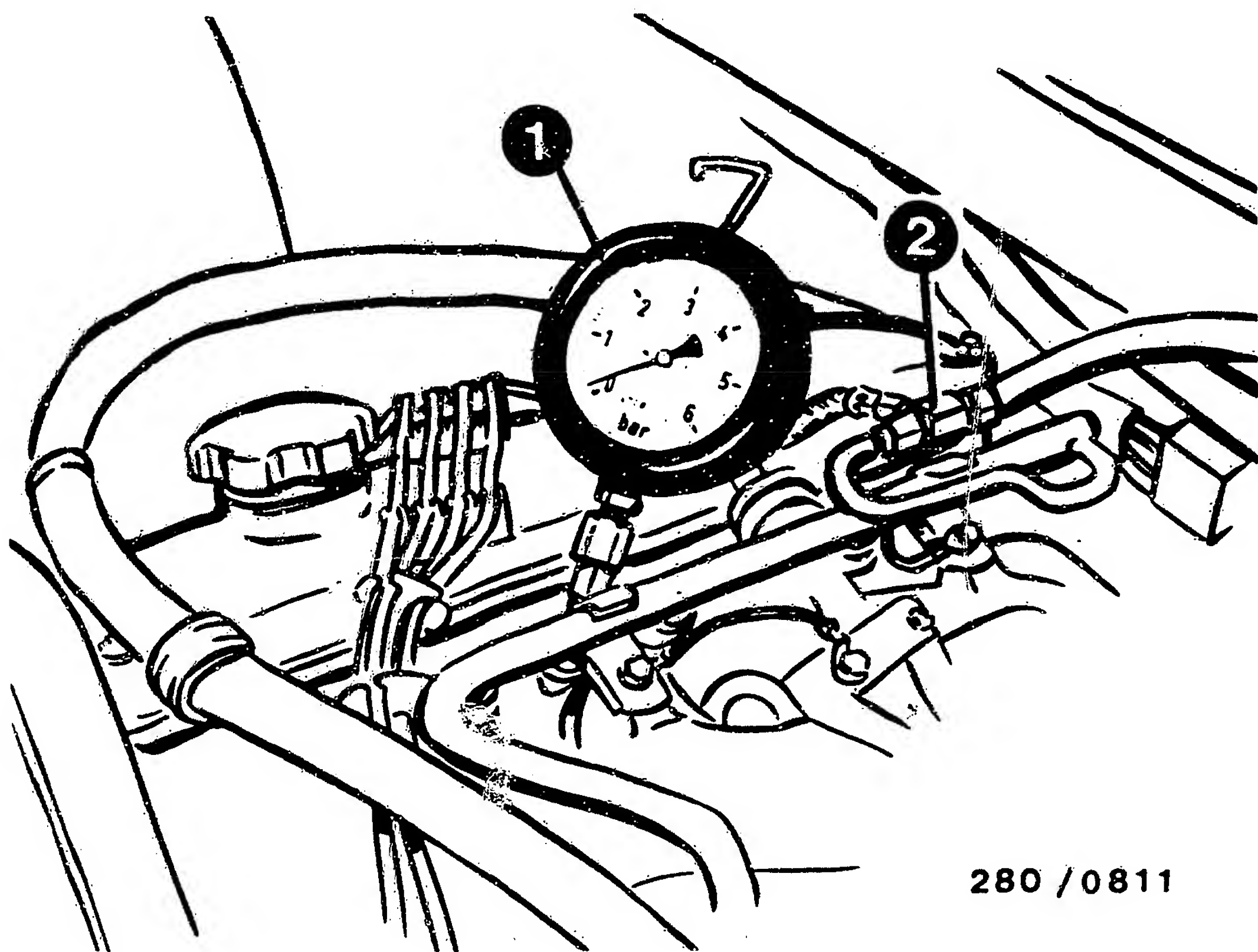
- 1 = Idle actuator
- 2 = Temperature sensor (engine)
- 3 = Pressure regulator
- 4 = Ground terminal

INSTALLATION POSITION OF COMPONENTS (continued)



- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Fuel suction line
- 4 = Fuel delivery line

Pre-supply pump in tank (accessible via trunk).



280 / 0811

- 1 = Pressure gauge
- 2 = Connection part KDJE-P 100/14

Fuel pressure test

CAUTION! When unscrewing hose, ensure that no fuel gets on to hot parts of engine.

Connect pressure gauge or pressure measuring device. Unscrew fuel delivery line at fuel distribution pipe.

Connect up connection part KDJE-P 100/14.

Make sure connection is tight.

For production reasons:
continued on the following
coordinate.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B03 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

Components, which are tested by way of self-diagnosis or using the universal test adapter, are not indicated in the trouble-shooting chart.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if envisaged). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of interlinkage of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness
- Ignition system O.K.

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)	Coord.
*	*	*	*	*	*	*	*			* Self-diagnosis	B13
*	*	*	*	*	*	*	*			* Switching-input diagnosis	B19
*	*	*	*	*	*	*	*			* Actuator diagnosis	B21
*				*						Voltage at control unit	G23
*	*	*	*		*					Air intake system	G25
*		*	*	*		*	*			Solenoid-operated injection valves	B25
				*	*					Fuel delivery	H01
*	*	*	*		*	*				Fuel pressure	H03
	*	*	*				*			Tank ventilation system	H11

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

							Cause (component fault)	Coord.
*	*						Start control	H17
			*				Overrun cutoff	H19
	*	*		*	*		Throttle valve	C17
	*	*	*	*	*	*	Lambda closed-loop control	C23
				*			Catalytic converter	H23
*	*	*	*				Interference	H25
	*						Pump noise	J01

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM

This vehicle is equipped with a control unit which has a self-diagnosis feature. Therefore, start trouble-shooting with the self-diagnosis.

How to activate the self-diagnosis is described starting on Coordinate B09. The self-diagnosis test table starting on Coordinate B13. contains:

- Fault indication (flashing code)
- Components or system functions under test
- Test instructions/test conditions
- Connection terminals
- Set-value specifications
- Coordinate references for trouble-shooting and fault rectification in the subsequent self-diagnosis trouble-shooting program.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (CONTINUED)

The self-diagnosis trouble-shooting program is split up into 3 columns as of Coordinate B23.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/terminal diagrams belonging to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be employed and the tests performed in the sequence indicated there.

If the self-diagnosis indicates a fault, but there is no system or component fault, the control unit is to be replaced.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (CONTINUED)

Following elimination of fault, clear fault memory and repeat test as a check.

Note: clearing is only possible once all faults have been output at least once. They cannot be cleared by switching off the ignition.

- * Exhaust-gas faults and faults of relevance to safety (Carb faults) are indicated continuously when they occur by the check-engine lamp in the instrument panel.

There are three types of diagnosis:

* Self-diagnosis

The faults detected by the control unit are stored. The faults can be indicated by way of the lamp (LED) in the diagnosis unit.

* Switching-input diagnosis

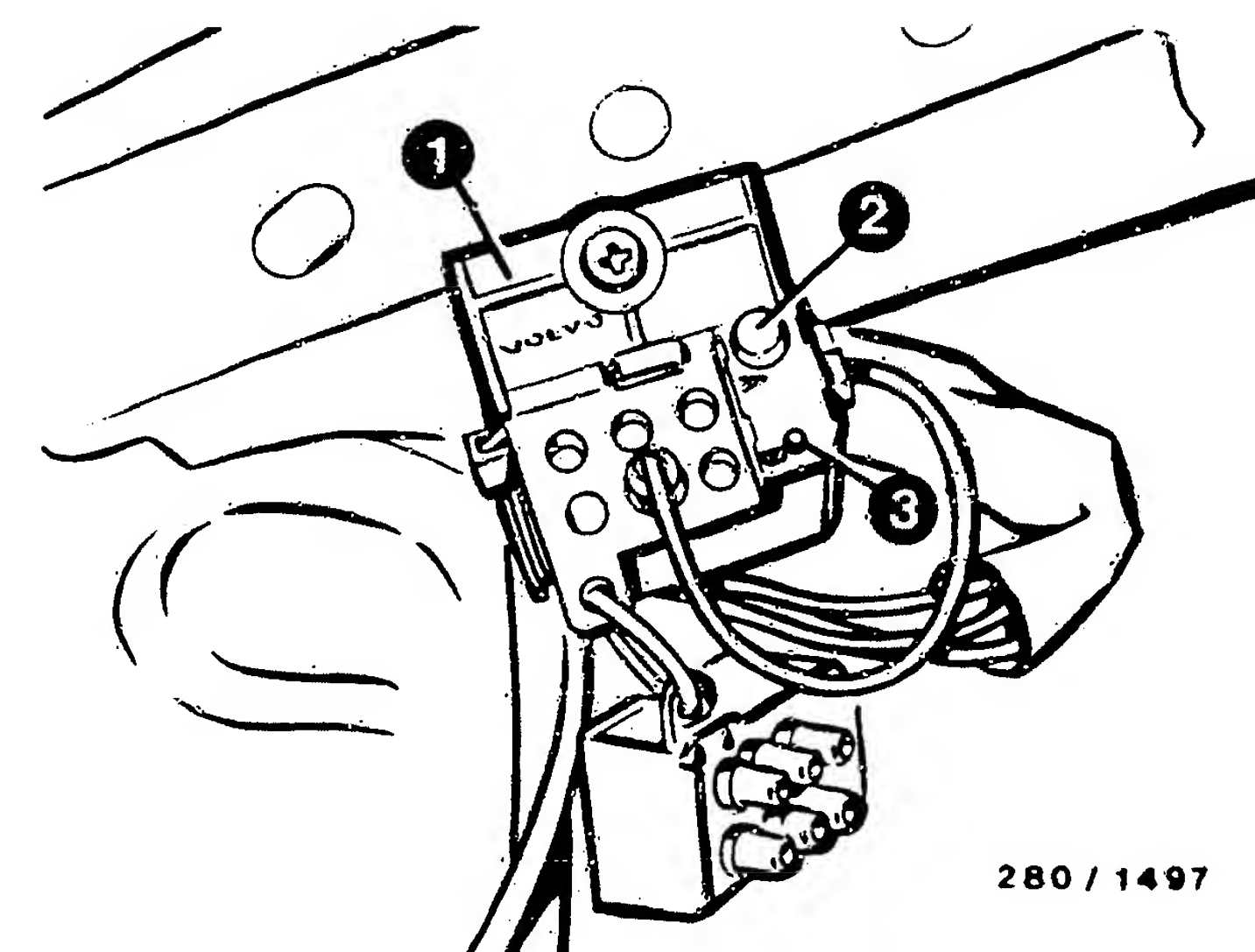
This is used to test the function of the switches, e.g. the throttle-valve switch. Following actuation, a flashing code is output as confirmation.

* Actuator diagnosis

The actuators, e.g. solenoid-operated injection valve, idle actuator and tank ventilation valve, are activated by the control unit.

Clearing the memory: see Section headed "Activation of self-diagnosis" on following coordinate.

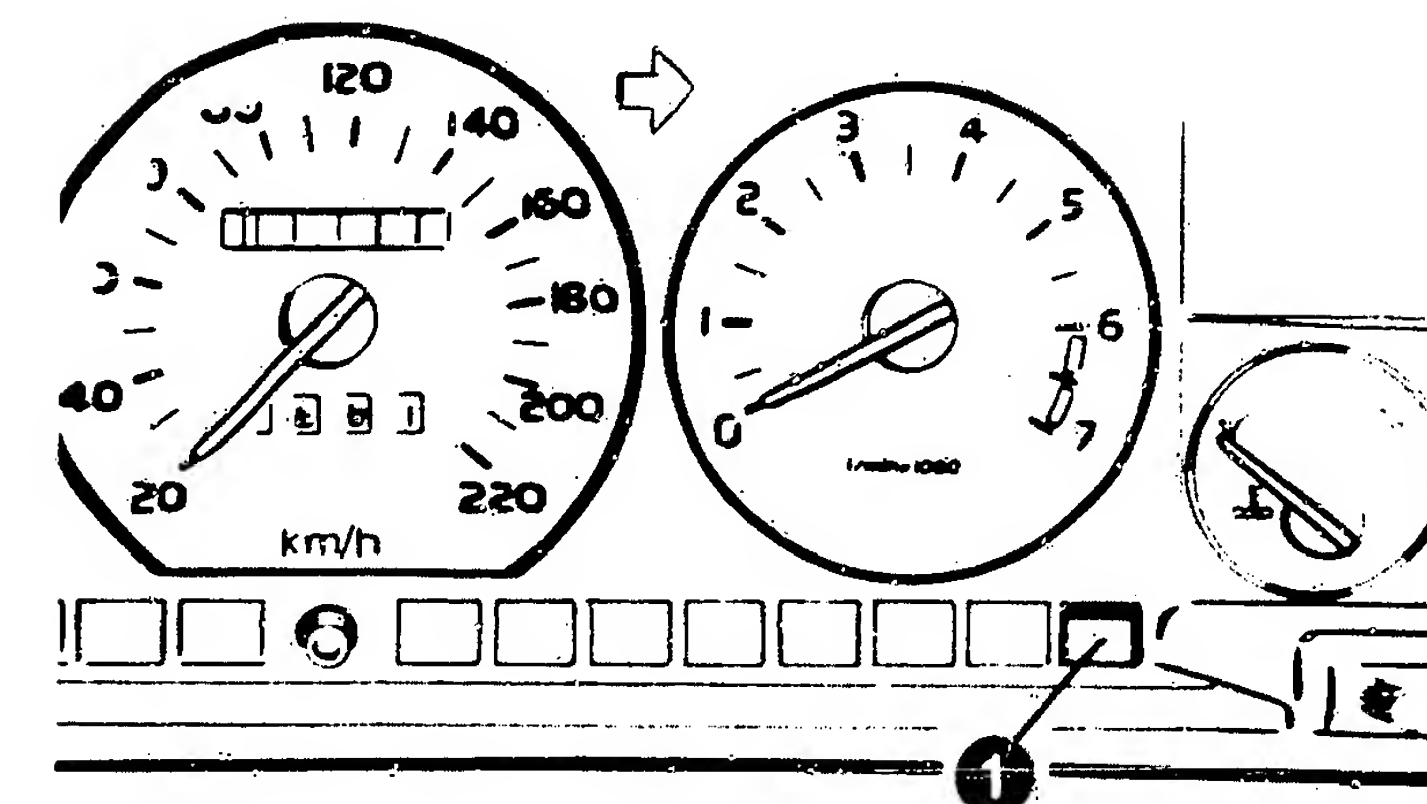
If no further system-specific faults are indicated by the self-diagnosis and the customer complaint (fault symptom) has still not been eliminated, trouble-shooting must be continued with the trouble-shooting chart as of Coordinate B03.



280 / 1497

- 1 = Diagnosis unit
- 2 = Button
- 3 = Indicator lamp (LED)

- 1 = Check-engine lamp



280 / 1498

ACTIVATION OF SELF-DIAGNOSIS

Prior to activation (triggering) of the self-diagnosis, a test drive must be performed under the following conditions for at least 5 minutes to ensure that the control unit detects existing faults:

- * Coolant temperature at least 80° C.
- * Engine speed must exceed 3000 min⁻¹ at least once.
- * Accelerator pedal must be fully depressed at least once.

After the test drive, the engine must be allowed to run for at least another 2 minutes at idle.

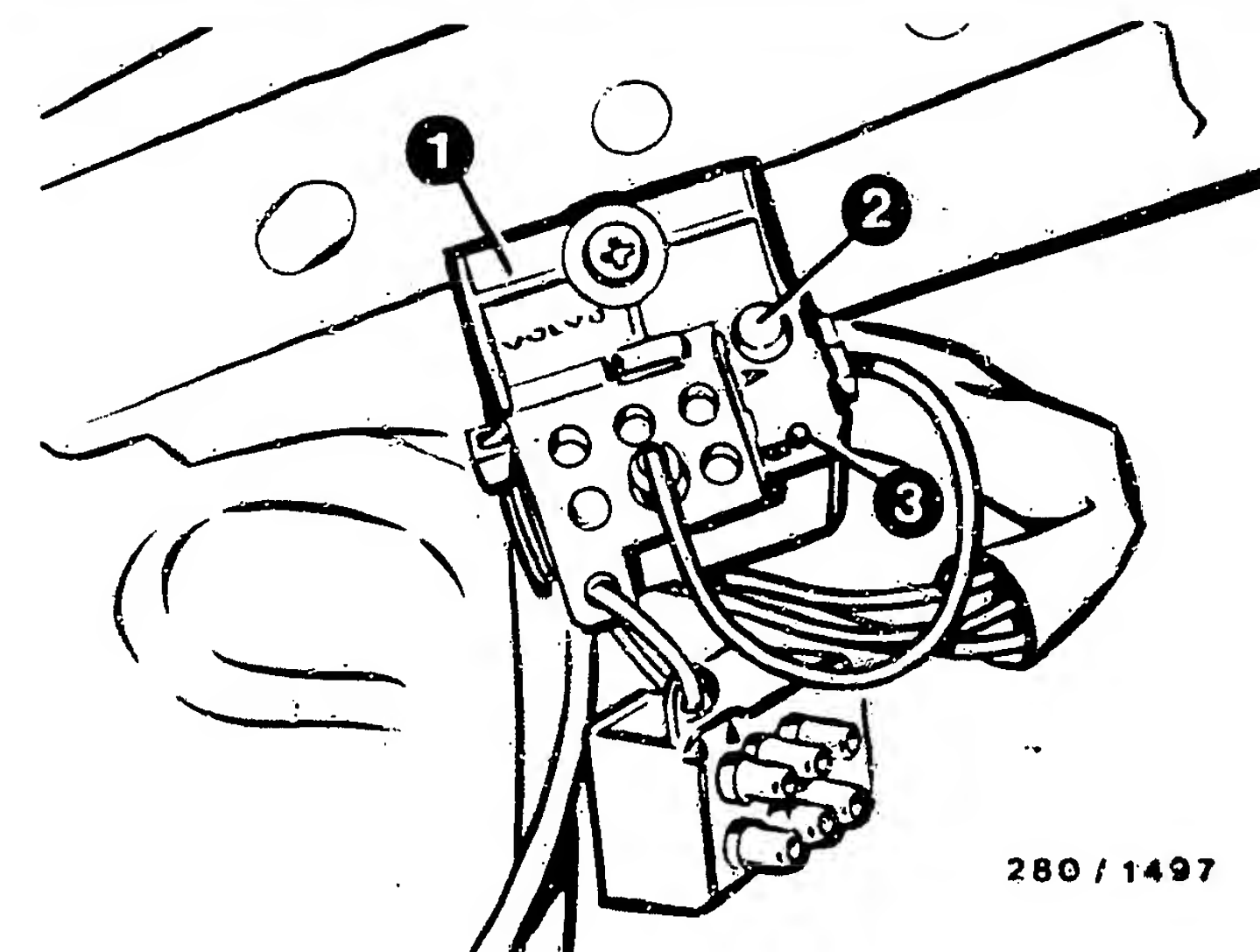
The self-diagnosis can then be activated with the engine running (idle speed) and with the engine stopped and the ignition switched on.

If the engine doesn't run, the motor must be started for at least 6 seconds to enable the control unit to detect existing faults. Then activate self-diagnosis.

Activation of self-diagnosis: insert lead from diagnosis unit into socket 2. Press button for at least 2.5 s. Flashing code is indicated by the indicator lamp (LED).

Activation of switching-input diagnosis: insert lead from diagnosis unit into socket 2. Press button twice for at least 2.5 s. Flashing code is indicated by the indicator lamp (LED). A switch-actuation prompt causes the indicator lamp to flash. Following actuation, the respective switch code is displayed by the indicator lamp.

Activation of actuator diagnosis: insert lead from diagnosis unit into socket 2. Press button 3 times for at least 2.5 s. The indicator lamp (LED) flashes in line with the actuation rhythm of the activated component. The components are actuated one after the other. The control unit switches itself off automatically after three repeats.



280 / 1497

- 1 = Diagnosis unit
- 2 = Button
- 3 = Indicator lamp (LED)

ACTIVATION OF SELF-DIAGNOSIS (CONTINUED)

Actuation of the diagnosis switch and a waiting period of 3.5 s are followed by the flashing code in 3 flashing-pulse groups with up to 9 flashing pulses in each case.

Renewed stimulation with the diagnosis switch results in output of the next fault. If all faults have been output, stimulation leads to re-starting with the first fault.

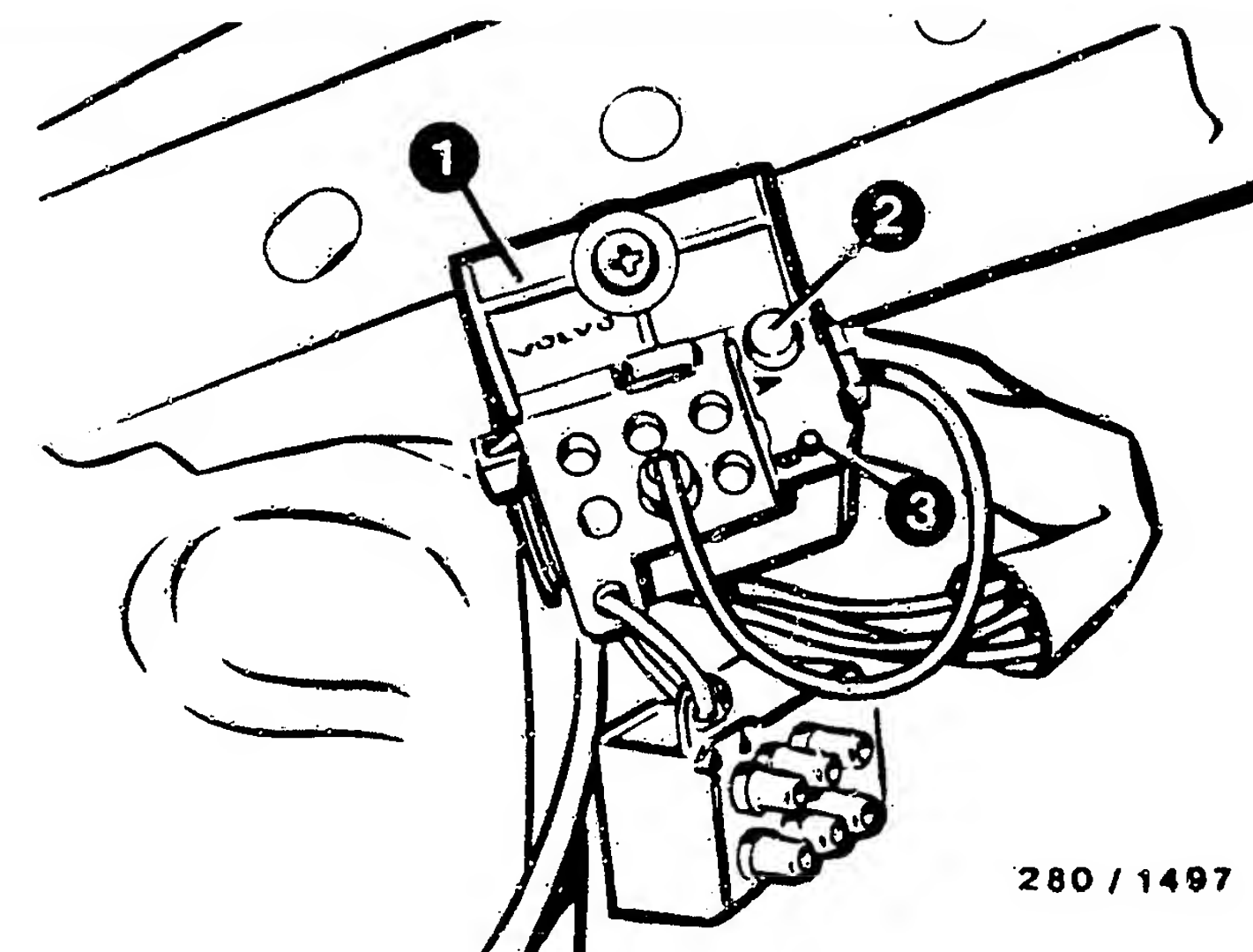
The flashing code " 1 1 1 " is output if there are no stored faults.

Self-diagnosis is terminated by renewed stimulation for a different mode (switching-input or actuator diagnosis), a clearing prompt or a brief increase in engine speed to in excess of 2500 min⁻¹.

The fault memories must be cleared before the control unit can store faults again:

- * Switch on ignition
- * Effect stimulation with diagnosis switch for more than 5 s.
- * Wait until LED (diagnosis unit) lights up.
- * Effect stimulation again with diagnosis switch for more than 5 s.

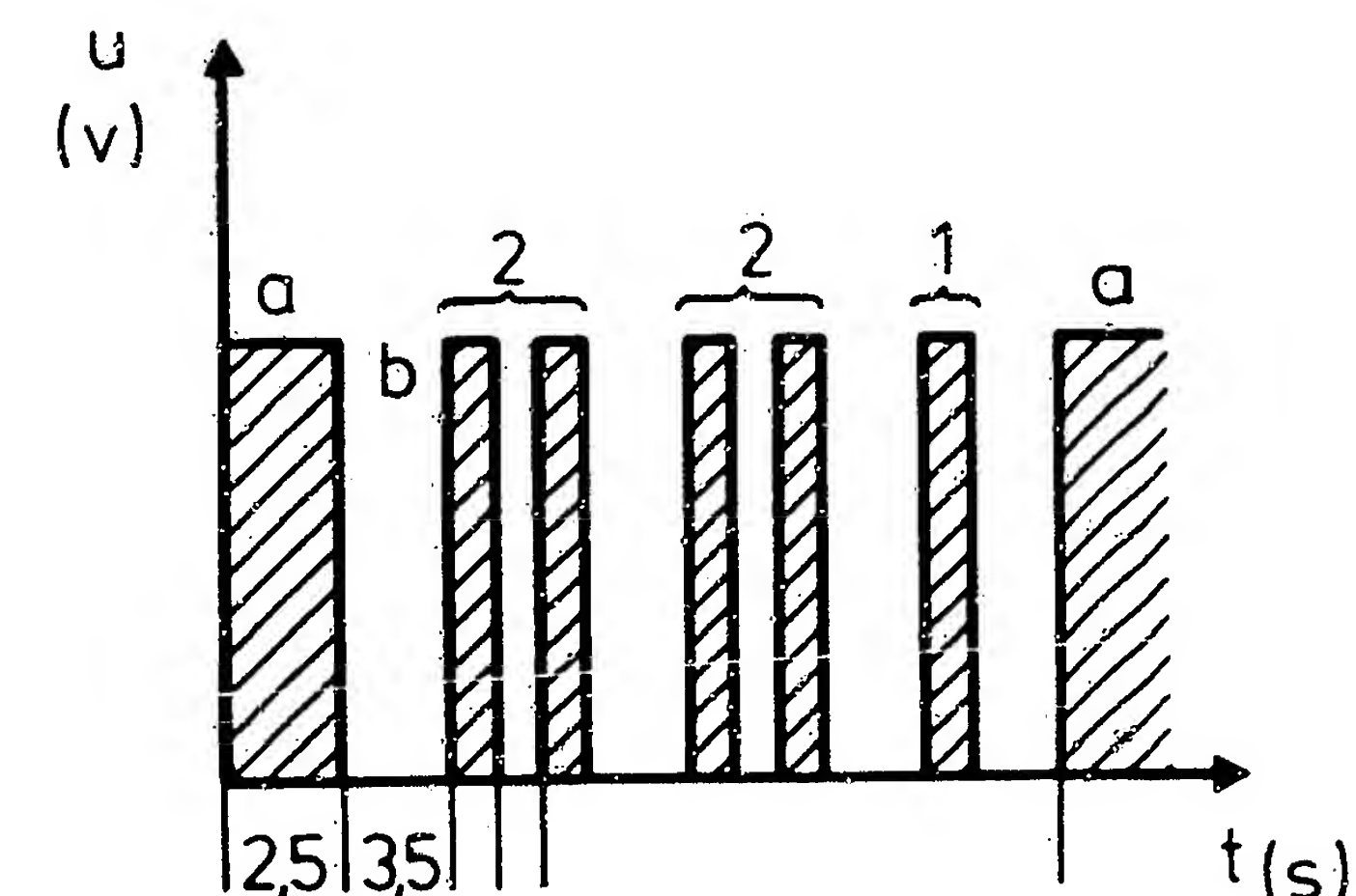
After clearing has been effected, activate self-diagnosis again. The displayed fault code must be "1 1 1".



280 / 1497

- 1 = Diagnosis unit
- 2 = Button
- 3 = Indicator lamp (LED)

- a = Start signal (diagnosis activation)
- b = Pause prior to first block



280 / 1504

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values	Coord.
1 1 1	No fault detected		—	—	—
1 1 2	Control unit	This fault is indicated by the check-engine lamp lighting up continuously when driving. Replace control unit without further testing.	—	—	B23
1 1 3	Solenoid-operated injection valves	Test internal resistance of injection valve Test connecting leads between control unit and injection valves for short-circuit and open-circuit. Test leads from main relay by way of auxiliary relay	18	See brief instructions	B25
1 2 1	Hot-wire air-mass meter	Switch on ignition Measure voltage at connector Start engine Measure voltage at connector Voltage is dependent on load Test resistance at hot-wire air-mass meter	5 - 1 (+) (-) 3 - 2 (+) (-) 3 - 2	8...15 V 2...5 V See brief instructions	C03
1 2 3	Temperature sensor (engine) and lead	Measure resistance directly at temperature sensor: +15...+30°C: approx. +80°C: Test leads from control unit to temperature sensor (NTC).	13 -NTC NTC- ground	1.45...3.3 k Ω 280...360 Ω Approx. Ω Approx. Ω	C09
1 3 1	No engine-speed signal	Test lead from LH control unit, term. 1 to EIK control unit for continuity. Test ignition signal with Motortester at control unit, term. 1.	1 - 17	Approx. Ω	C13

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values	Coord.
1 3 2	Supply voltage of control unit with engine running	Supply voltage too low: Test voltage drop at positive and ground terminal. Charge battery, test alternator system. Supply voltage too high: Test alternator system.	9 - 5 (+) (-)	8...15 V with engine running	C15
1 3 3	Throttle-valve switch (idle) and lead	Incorrect idle-switch setting. Test resistance directly at throttle-valve switch. Throttle valve closed: Throttle valve open: Test lead from control unit to throttle-valve switch.	2 - 18 2 - 2	0 Ω Infinity Ω Approx. Ω	C17
2 1 2	Lambda sensor	Open-circuit in lead to lambda sensor, short- circuited to ground or battery voltage. Watch out for worn cable insulation! Test sensor heater. Sensor clogged.	24		C19
2 1 3	Throttle-valve switch (full load) and lead	Test resistance directly at throttle-valve switch. Throttle valve closed: Throttle valve open: Test lead from control unit to throttle-valve switch.	3 - 18 3 - 3	Infinity Ω Approx. Ω Approx. Ω	C21
2 2 1	Lambda closed-loop control not within working range (closed- loop control limits exceeded or dropped below)	Open-circuit in lead to lambda sensor, short- circuited to ground or battery voltage. Watch out for worn cable insulation! Test sensor heater. Sensor clogged Intake system leaking, test Tank ventilation valve permanently open, test Injection valves defective, test Hot-wire air-mass meter defective, test	24		C23

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Termi- nals	Set values	Coord.
2 2 3	No idle-speed regula- tion function.	Test voltage supply at idle actuator Test lead from control unit to idle actuator for continuity. Test resistance directly at idle actuator Test signal at control unit.	2-grnd. 32	8...15 V Approx. 0 Ω See brief instructions	E05
2 3 1	Adaption limits of lambda closed-loop control (multi)	Test intake system for leaks. Test function of lambda closed-loop control. Test fuel pressure. Test tank ventilation system. Test injection valves for proper functioning and freedom from leaks. Test functioning of hot-wire air-mass meter. Fuel tank run empty.			E09
2 3 2	Adaption limits of lambda closed-loop control (additive)				E25
3 1 1	Speed signal	Test signal at control unit Test lead from speed sensor to control unit for continuity.	34 34	Approx. 0 Ω	F21
3 1 2	Lambda open-loop control (knock enrich- ment)	Test lead from control unit to ignition control unit for continuity.	28 - 4	Approx. 0 Ω	F23
3 2 2	Self-cleaning of air- mass meter	Test lead from control unit to hot-wire air-mass meter for continuity.	8 - 4	Approx. 0 Ω	F25

SWITCHING-INPUT-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values	Coord.
- - -	Idle switch	LED flashes, actuate idle switch. Following actuation of switch, LED flashes with respective flashing code.	2	See brief instructions	F27
- - -	Full-load switch	LED flashes, actuate full-load switch. Following actuation of switch, LED flashes with respective flashing code.	3	See brief instructions	G01
- - -	Engine-speed signal	LED flashes, start engine. After starting, LED flashes with respective flashing code.	1	See brief instructions	G03
- - -	A/C standby switch	LED flashes, actuate A/C standby switch. Following actuation of switch, LED flashes with respective flashing code.	15	See brief instructions	G05
- - -	A/C compressor switch	LED flashes, start engine. Actuate A/C switch. Following actuation of switch or switch-on of compressor, LED flashes with respective flashing code.	14	See brief instructions	G07
- - -	Drive switch (automatic transmission only)	LED flashes, actuate drive switch. Following actuation of switch, LED flashes with respective flashing code.	30	See brief instructions	G07

ACTUATOR-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values	Coord.
	Solenoid-operated injection valves	Detach plugs from all injection valves. Connect one injection valve in each case. It must be possible to hear the connected injection valve working. Perform test consecutively on all injection valves. Test internal resistance of injection valves (+15...+30°C) Test connecting leads from control unit to injection valves for short-circuit and open-circuit. Test lead of main relay.	18	Indicator lamp (LED) flashes in line with actuation rhythm of component See brief instructions	G11
	Idle actuator	It must be possible to hear/feel idle actuator working. Test internal resistance of idle actuator. Test leads from control unit/ignition and starting switch to idle actuator for short-circuit and open- circuit.	33	Indicator lamp (LED) flashes in line with actuation rhythm of component See brief instructions	G15
	Tank ventilation valve	It must be possible to hear/feel tank ventilation valve working. Test internal resistance of tank ventilation valve. Test leads from control unit/ignition and starting switch to tank ventilation valve for short-circuit and open-circuit.	27	Indicator lamp (LED) flashes in line with actuation rhythm of component See brief instructions	G19

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (1)

SELF-DIAGNOSIS FLASHING CODE 112
Test control unit

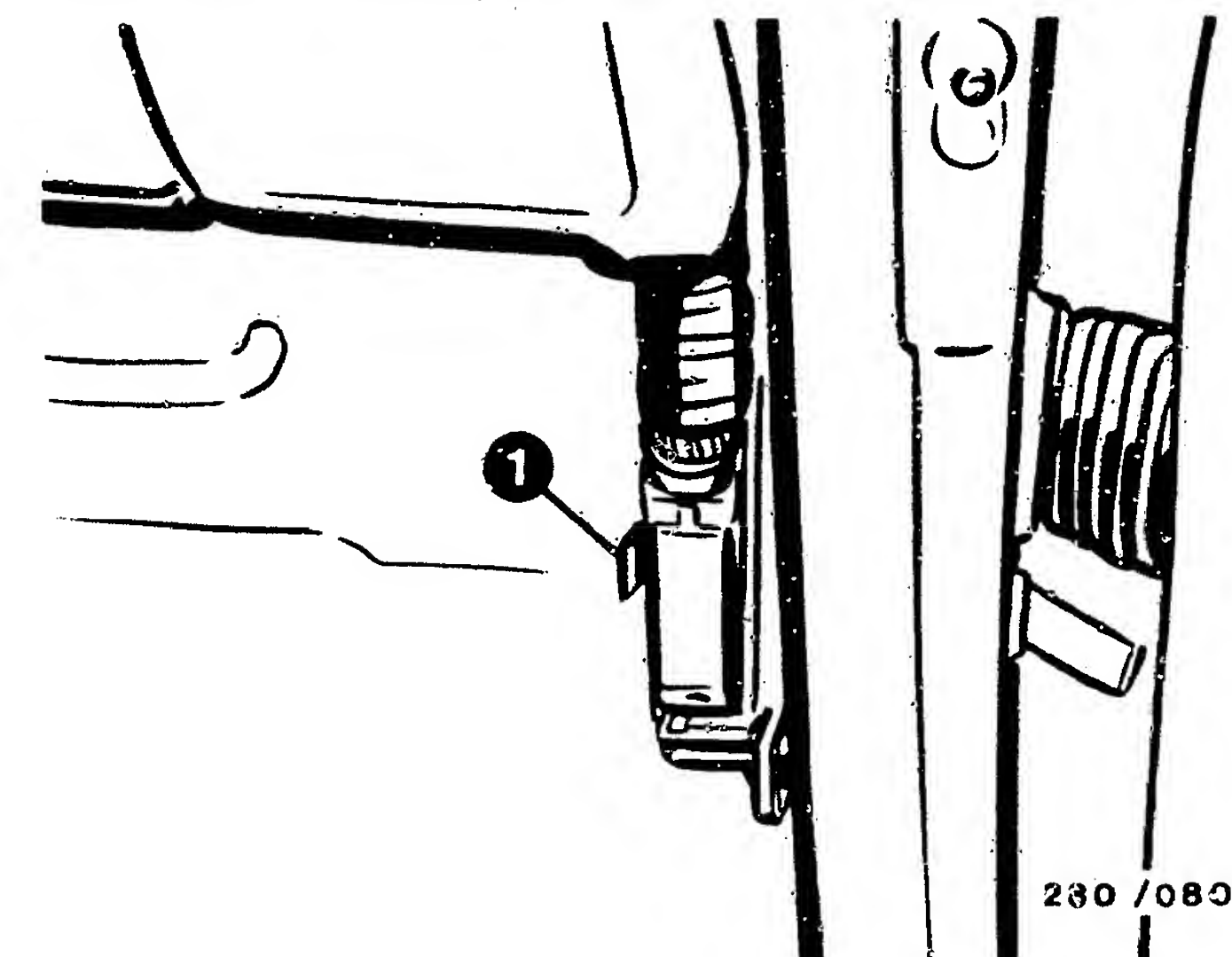
This fault is indicated by the
check-engine lamp lighting up
continuously when driving.

No further testing of the control
unit is required.

No flashing code?

Replace control unit

The control unit is located beneath
a cover on the right-hand side of
the front passenger's footwell.



Return to self-diagnosis
test table B13

B23

B24

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2)

SELF-DIAGNOSIS FLASHING CODE 113

Test solenoid-operated injection valves.

Detach plugs at solenoid-operated injection valves.

Connect ohmmeter to solenoid-operated injection valve.
Perform test on all injection valves.

Set value: see brief instructions

Is set value attained?

N>

Renew respective solenoid-operated injection valve.

Removal:

Detach connector.

Pull out retaining clip.

Remove injection valve.

Caution!

Catch fuel as it emerges; it must not be allowed to get on to hot parts of engine.

Fitting:

Only oil O-rings slightly (engine oil HD 30).

Attach injection valve to fuel distributor.

Insert retaining clip into groove and engage it.

Test for fuel leaks.

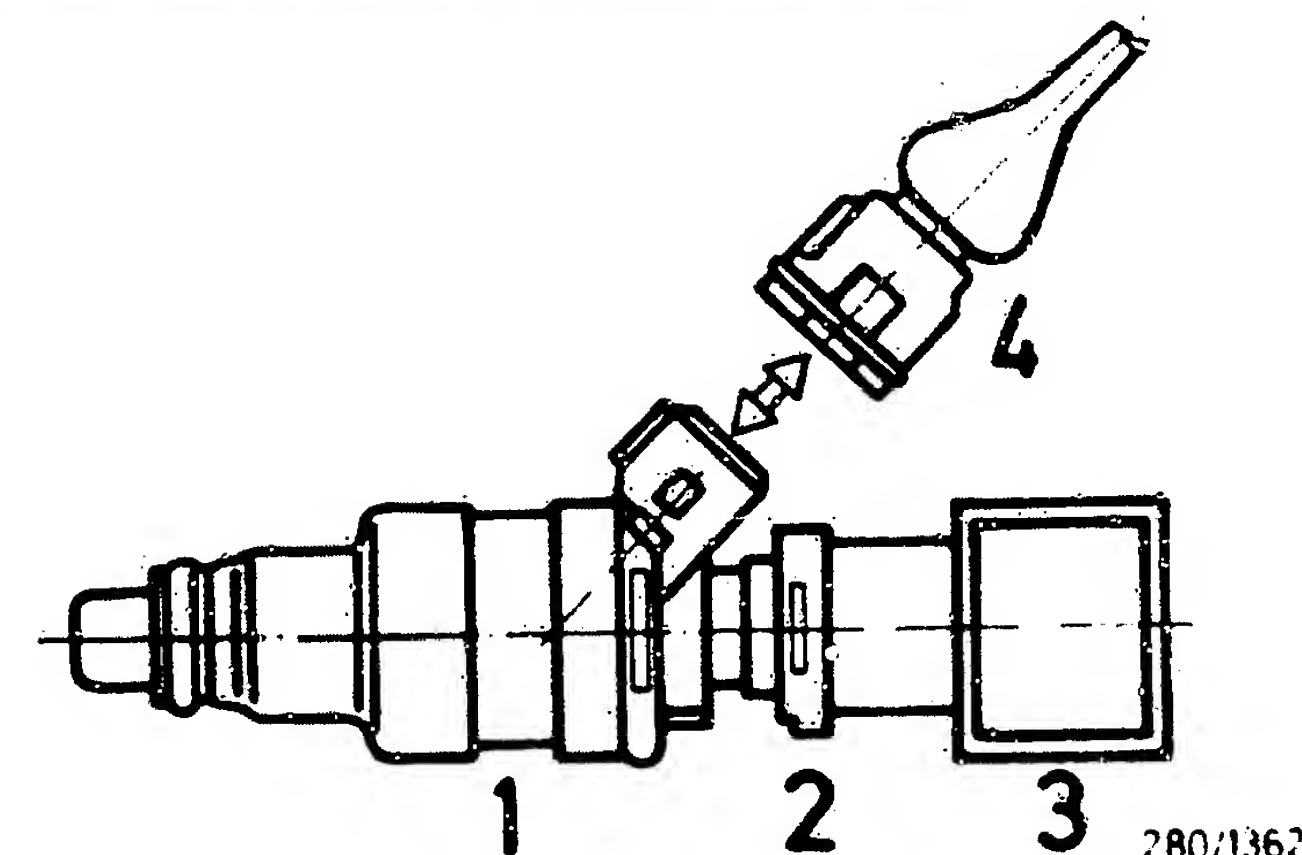
Attach connector.

Install complete fuel distributor.

In doing so, press all injection valves simultaneously into intake-manifold guide.

Caution!

Never damage O-rings or valve needle. Ensure that there are no intake-manifold leaks.



1 = Injection valve

2 = Holding clamp

3 = Fuel-distribution pipe

4 = Connector

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2) CONTINUED (1)

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

Set value: approx. 0 Ω

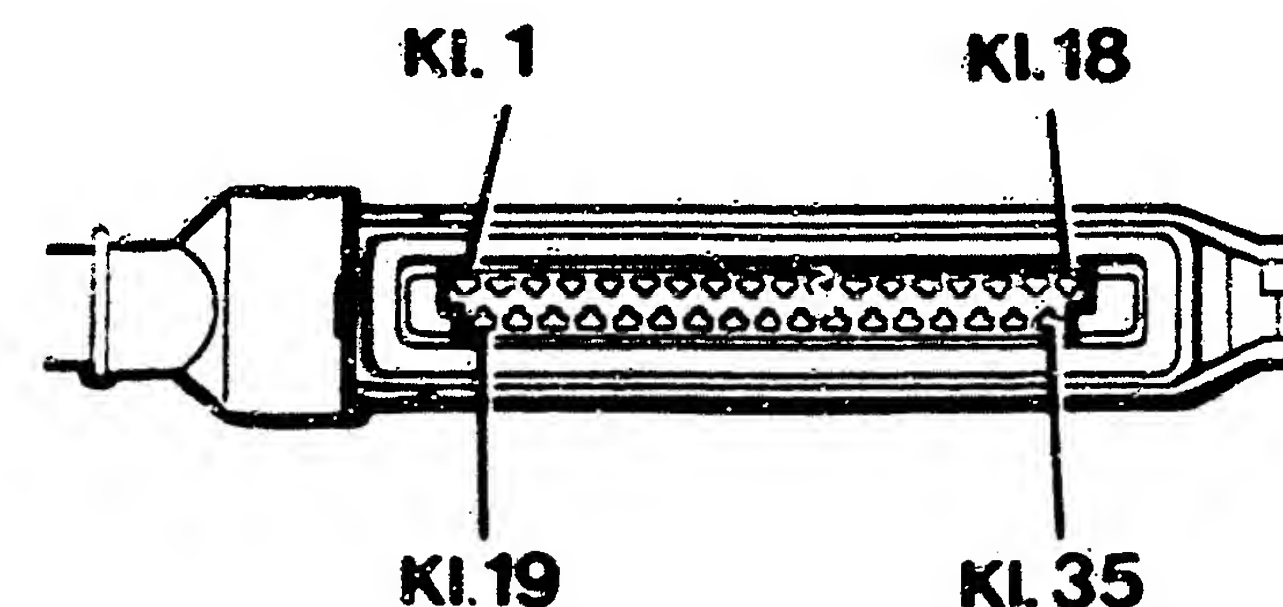
From control-unit plug term. 18 to connector of injection valve.

From pump relay term. 87 to connector of injection valve.

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/925

Detach connectors of solenoid-operated injection valves.

Switch on ignition

Measure voltage at connector term. 2 with respect to vehicle ground.

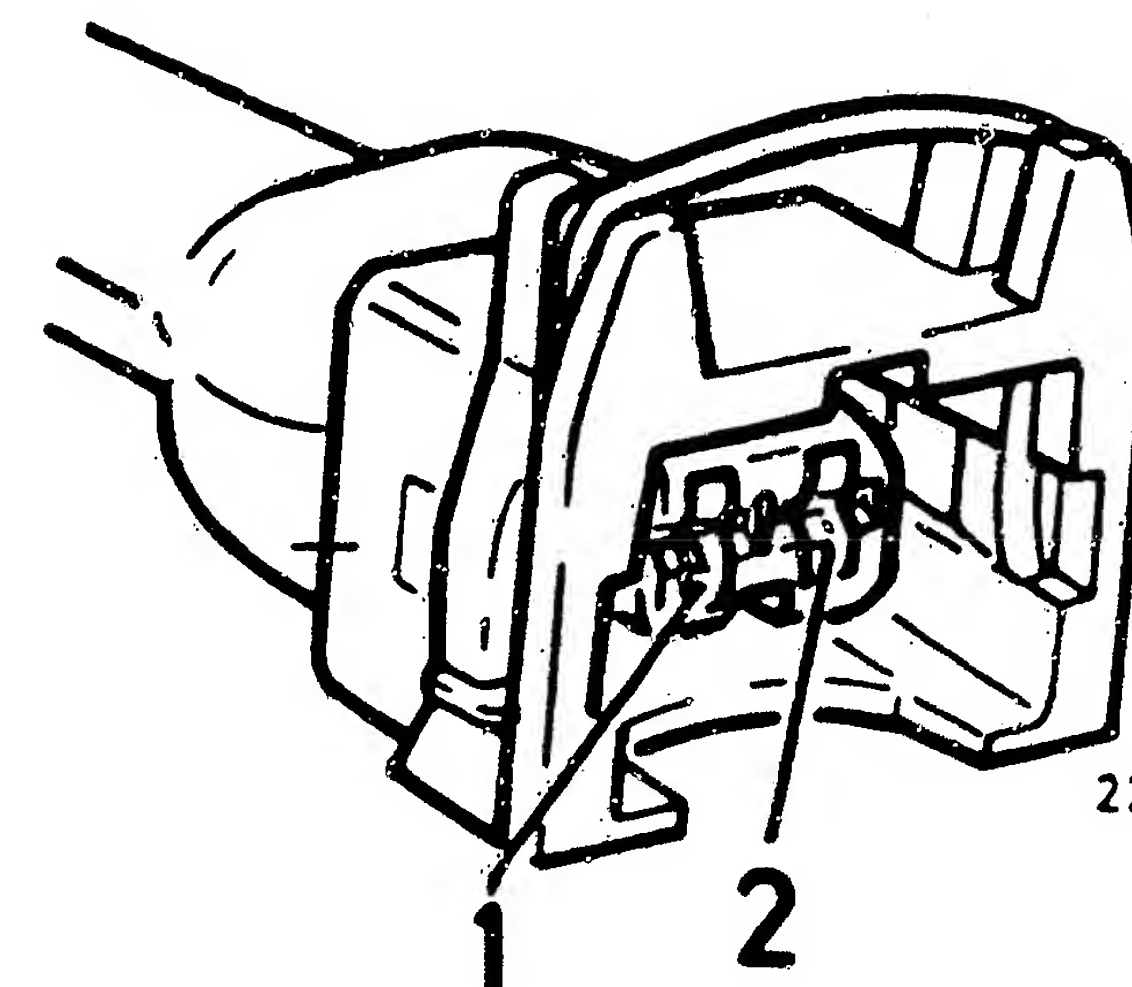
Perform test on all connectors.

Set value: 8...15 V

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/1036

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2) CONTINUED (2)

Check solenoid-operated injection valves with engine running.

With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

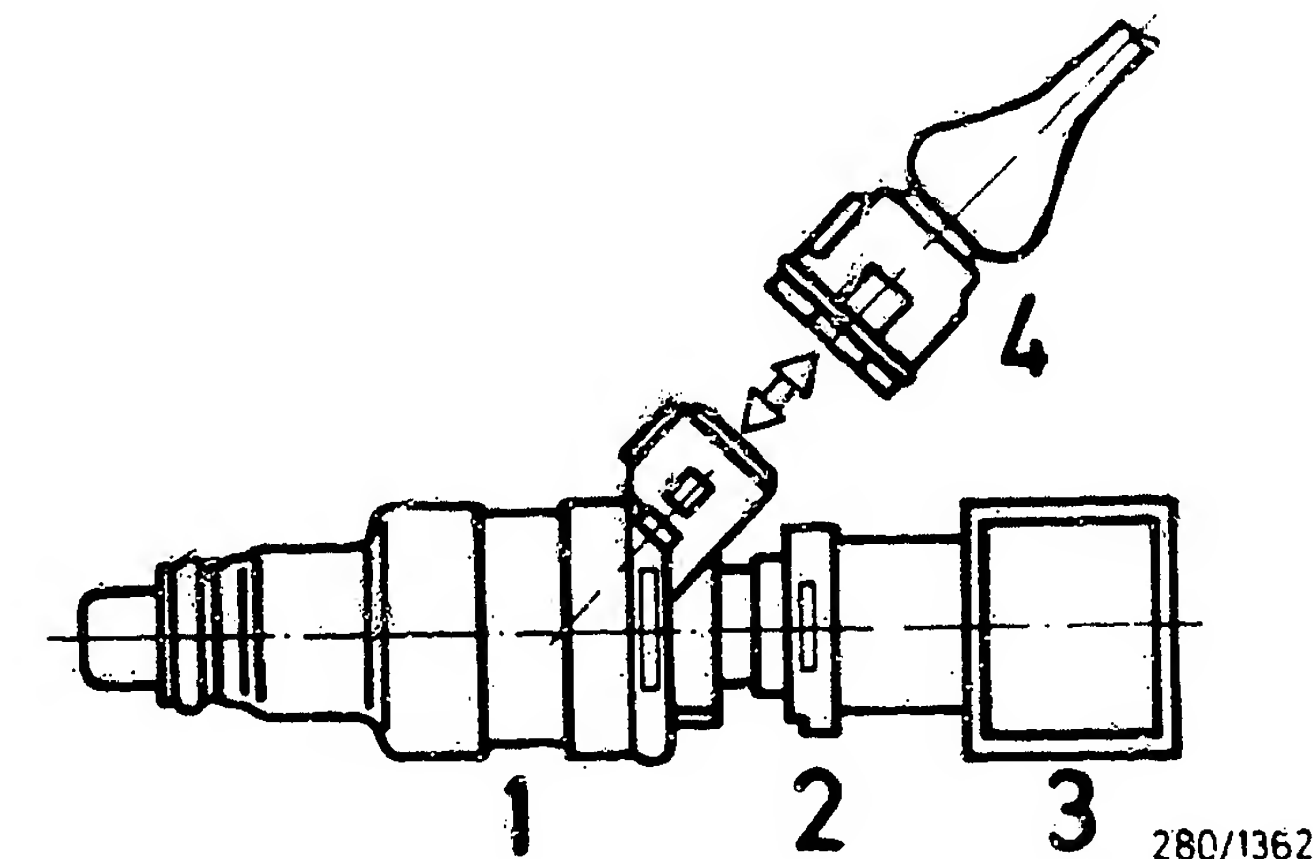
Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?

N>

No drop in engine speed =>
Replace injection valve
in question.



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

Return to self-diagnosis
test table B13

C01

<=>

C02

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (3)

SELF-DIAGNOSIS FLASHING CODE 121
Test hot-wire air-mass meter

Detach plug from hot-wire air-mass meter.

Connect ohmmeter to term.3 and
term.2 on hot-wire air-mass meter.
Set value: see brief instructions

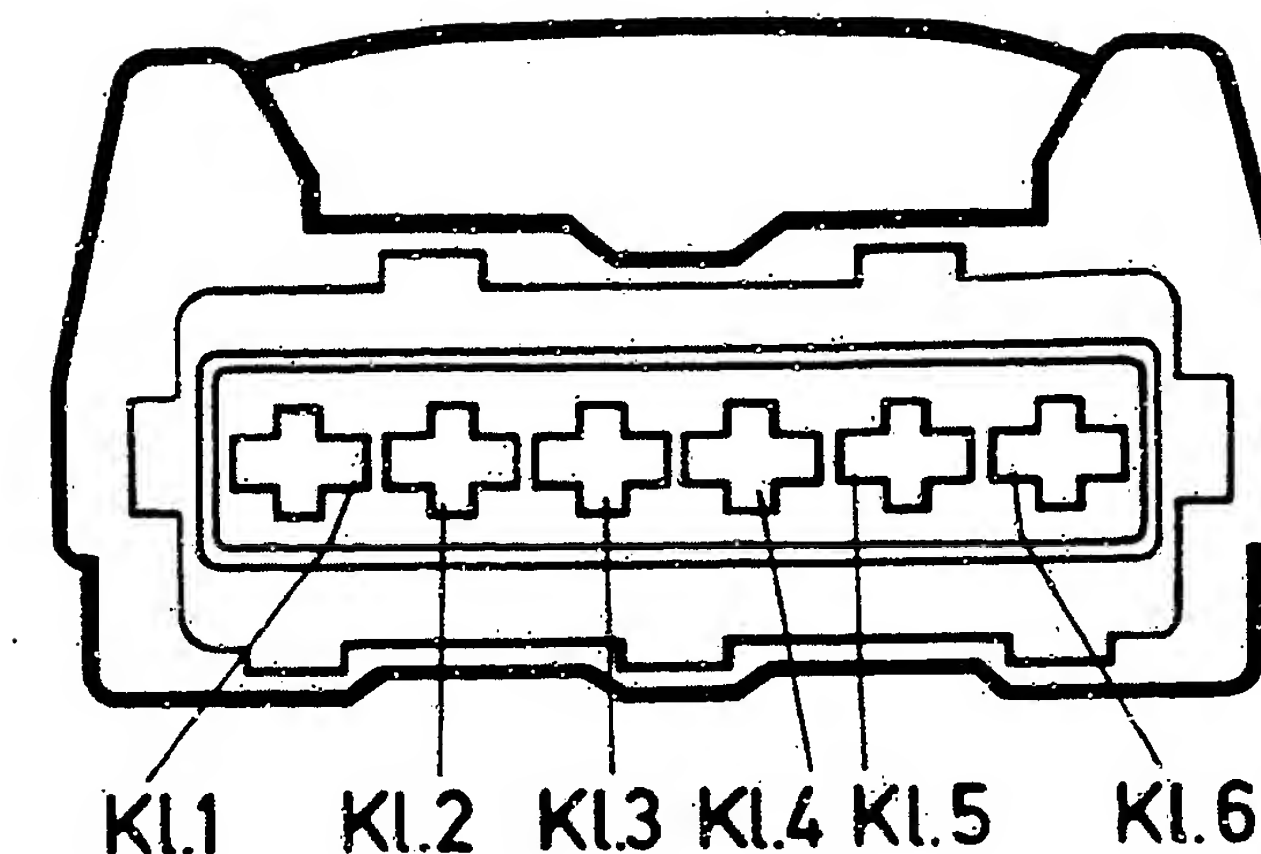
Is set value obtained?

Renew hot-wire air-mass meter.

Perform visual inspection of plug
for hot-wire air-mass meter:
Plug properly connected, contacts
corroded? Spring contacts must be
engaged and it must not be possible
to push them back.

Is plug O.K.?

Eliminate defects on plug.
If necessary, replace plug
or spring contacts.



280/1505

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (3) CONTINUED (1)

Use ohmmeter to test leads from hot-wire air-mass meter to control unit for continuity.

Set value: approx. 0 Ω

Air-mass meter to Control-unit plug

Term.2 Term.6

Term.3 Term.7

Term.4 Term.8

Lead from hot-wire air-mass meter term.5 to main relay term.87.

Set value: approx. 0 Ω

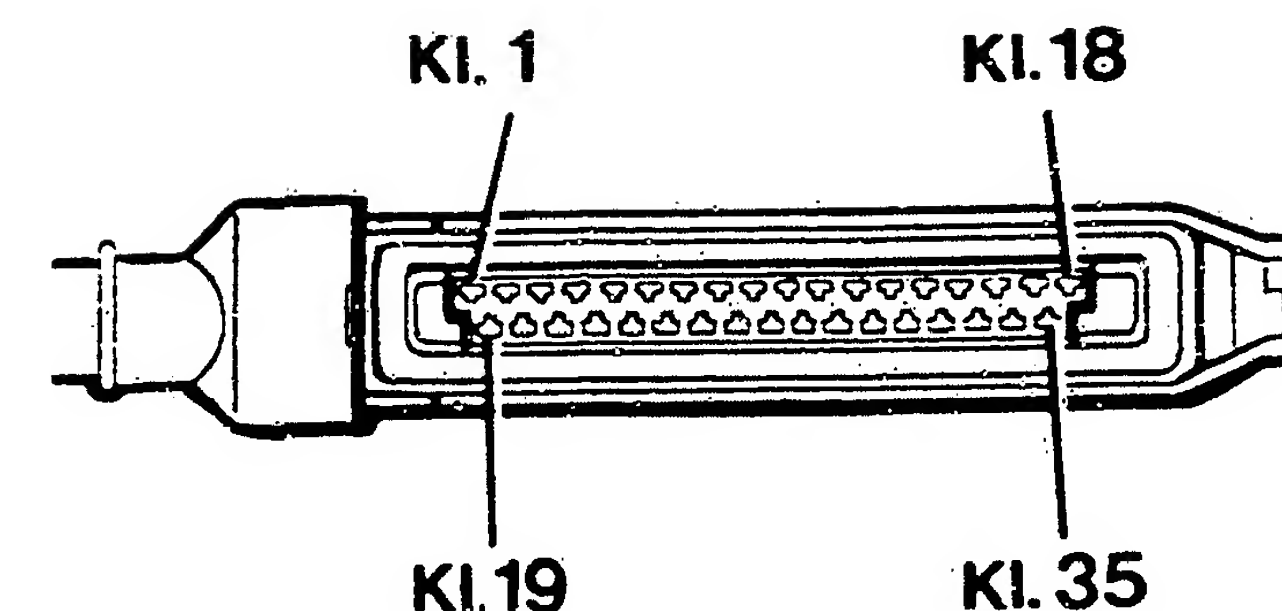
Lead from hot-wire air-mass meter term.1 to vehicle ground.

Set value: approx. 0 Ω

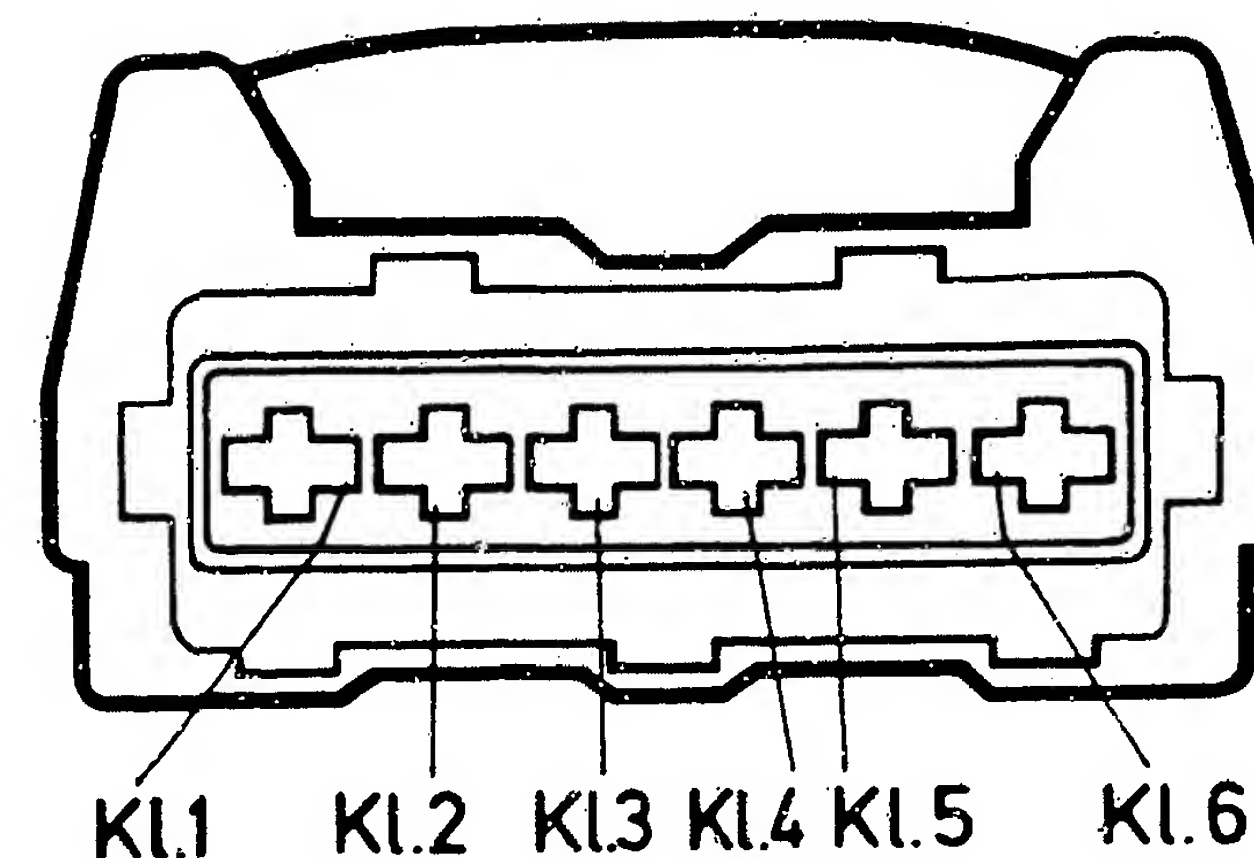
Watch out for worn cable insulation and loose contacts.

Are set values obtained?

Eliminate contact resistances, open circuits and short circuits in leads.



227/925



280/1505

Continued on next picture page

C05

<=>

C06

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (3) CONTINUED (2)

Push back rubber sleeve of hot-wire
air-mass meter.
Connect voltmeter with test prods
to term.5 (+) and term.1 (-)
(see top picture).
Switch on ignition.
Set value: 8...15 V

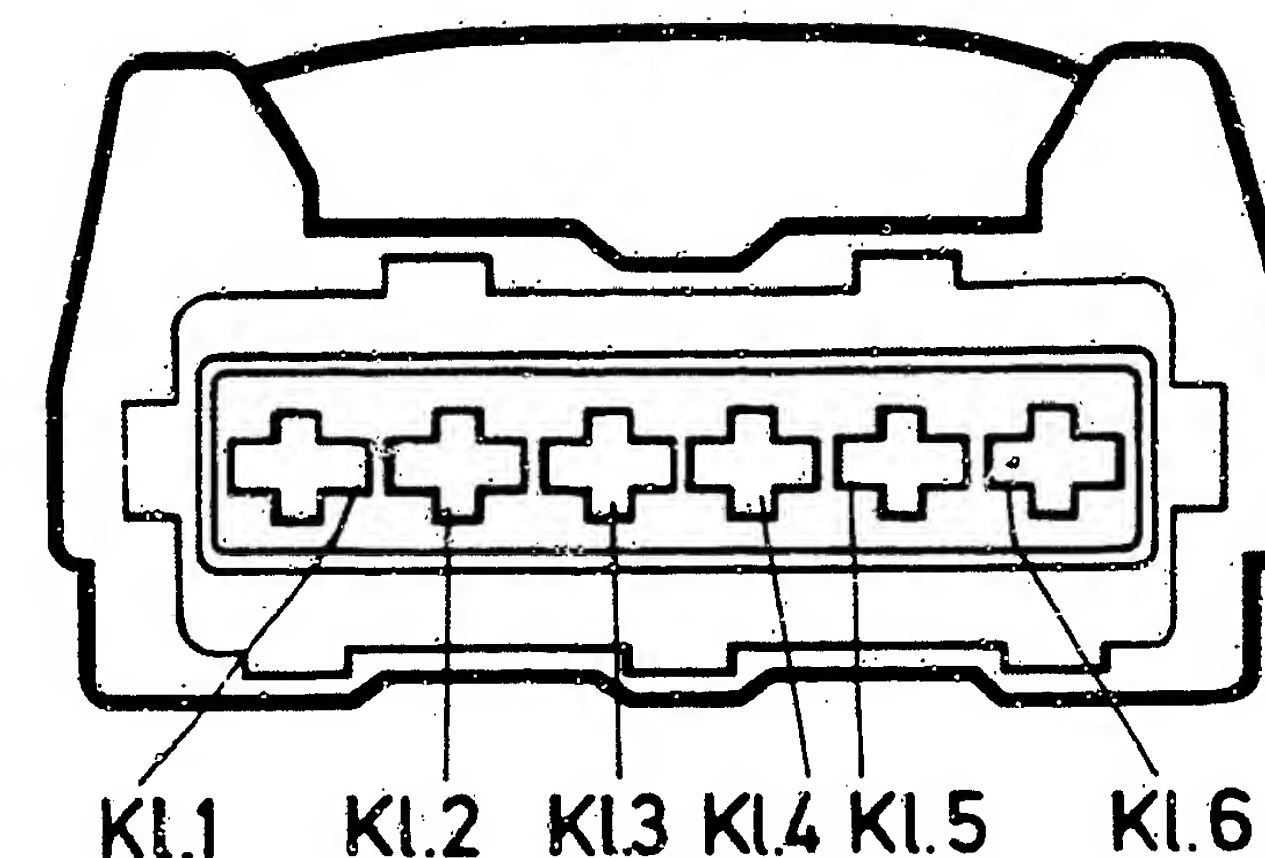
Measure voltage at term.3 (+)
and term.2 (-).
Start engine. Voltage is a function
of load.
Set value: 2...5 V

Are set values obtained?

N>

Visually inspect leads for contact
(worn insulation).

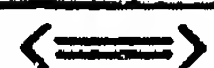
Control unit defective, renew.



280/1505

Return to self-diagnosis
test table B13

C07



C08



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4)

SELF-DIAGNOSIS FLASHING CODE 123

Test temperature sensor (engine):

Detach plug from temperature sensor.

Test resistance directly at temperature sensor:

Ambient temperature

+15°...30°C

Set value: 1.45...3.3 k Ω

Engine at operating temperature

approx. +80°C

Set value: 280...360 Ω

Is set value attained?

N>

Renew temperature sensor.

Y

V

Perform visual inspection of plug for temperature sensor:

N>

Eliminate defects on plug.
If necessary, replace plug or spring contacts.

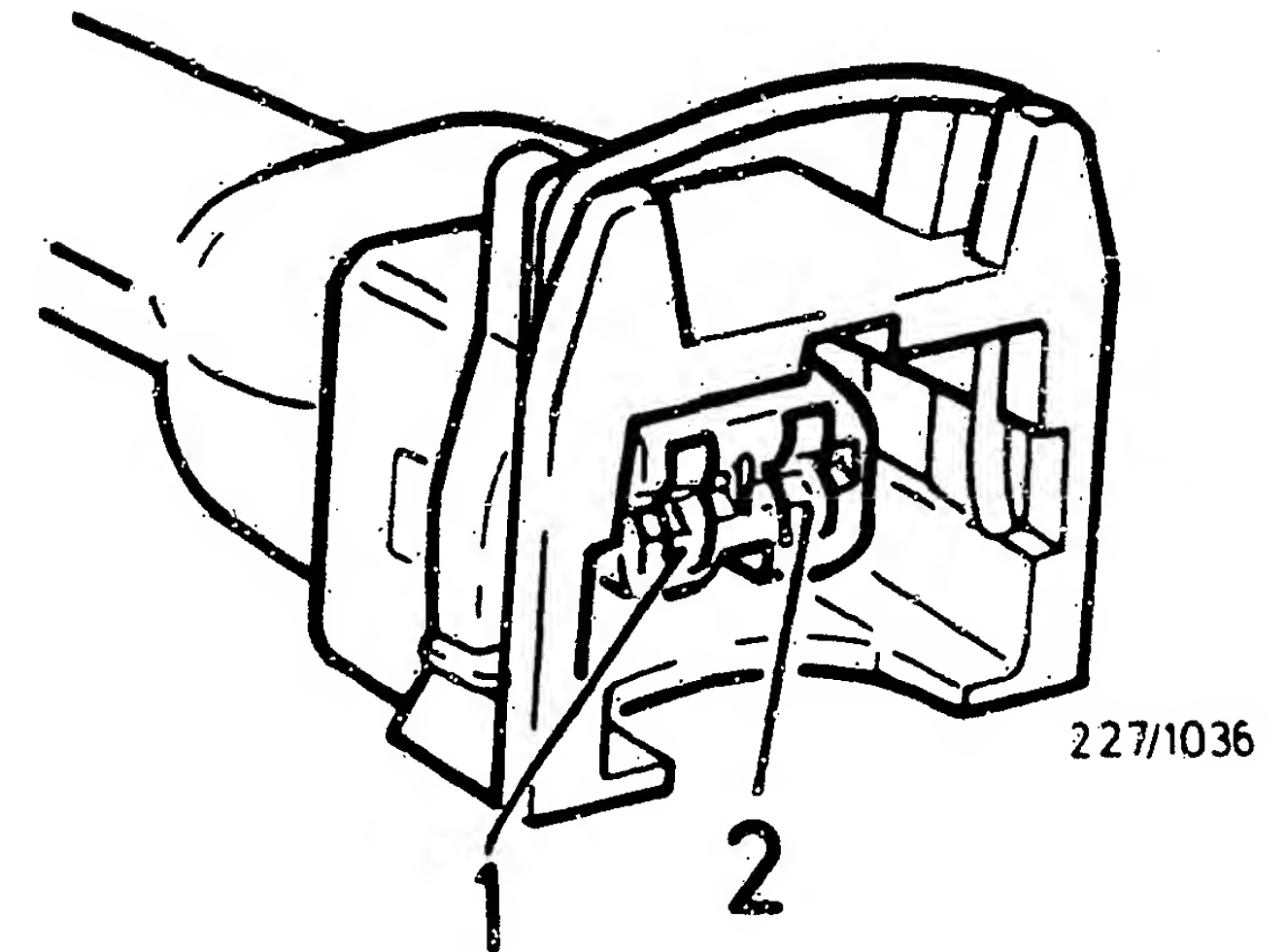
Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Y

V

Continued on next picture page



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4) CONTINUED (1)

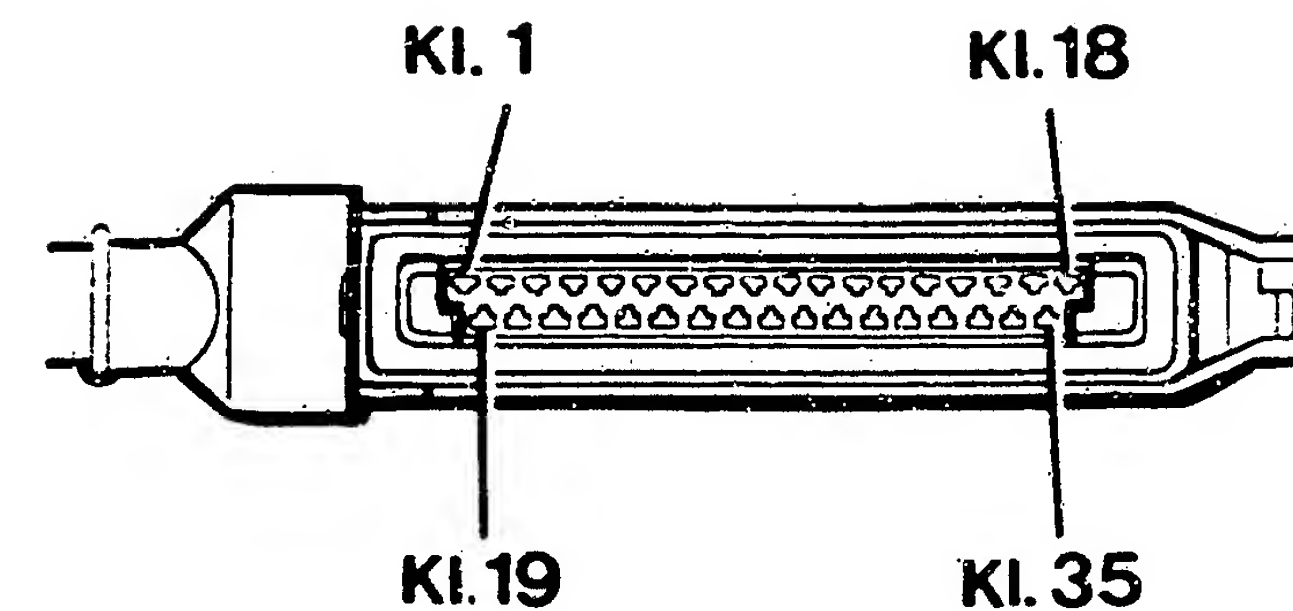
Use ohmmeter to test following leads for continuity
Set value approx. 0 Ω :

From control-unit plug term.13 to temperature sensor.

From control-unit plug term.5 to temperature sensor.

Is set value attained?

Eliminate contact resistances, open circuits and short circuits in leads.



227 925

Return to self-diagnosis test table B13

C11

<=>

C12

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5)

SELF-DIAGNOSIS FLASHING CODE 131

Test signal from term.1 or TD of ignition system.

Detach control unit plug.

Set Motortester to special input.
Lever on left stop
(calibrated voltage range).

Red tester terminal to control-unit plug term. 1.
Black tester terminal to vehicle ground.

Start engine

Set value: see pictures

Is set value attained?

N>

Detach control-unit plug.

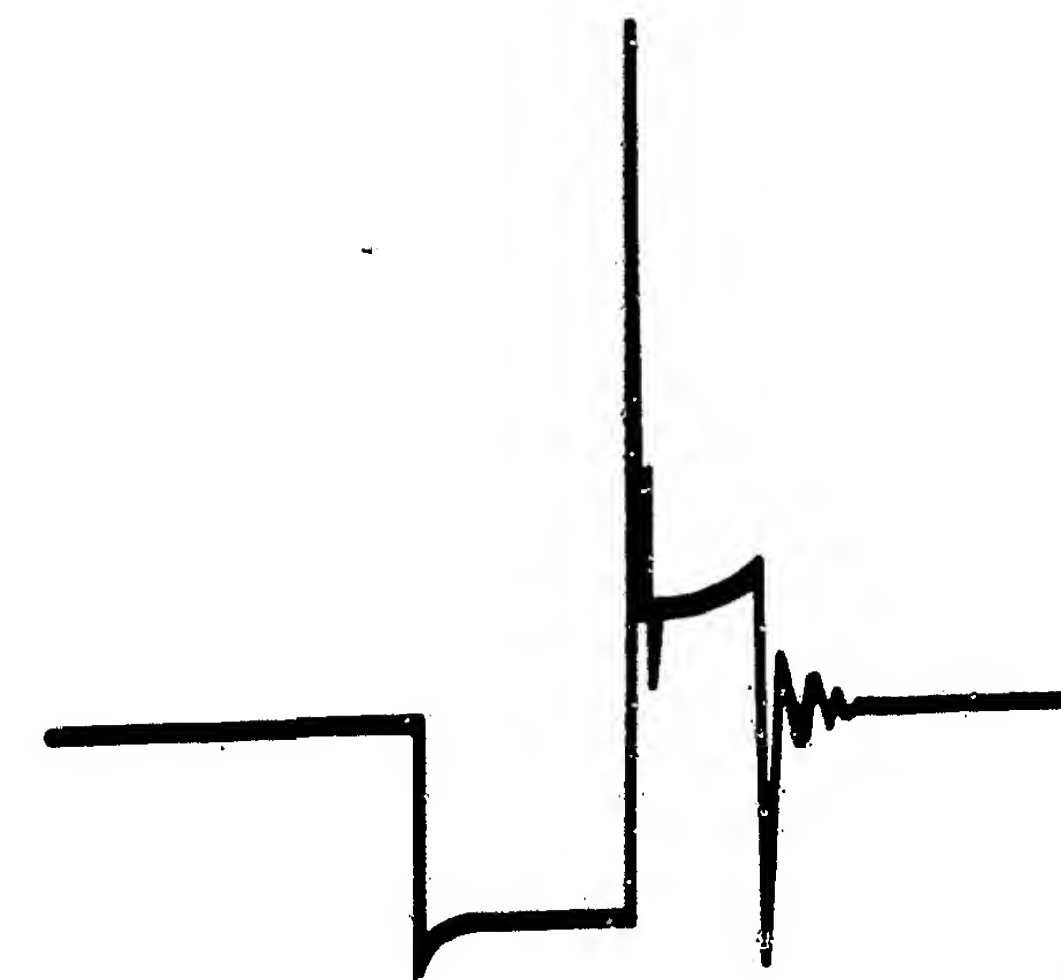
Use ohmmeter to test following lead for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 1 to ignition coil term. 1

With TD signal from control-unit plug term. 1 to ignition control unit term. 17.

If leads are O.K., check ignition system.

Repair faulty lead or plug.



261/0212

Term. 1 signal from term. 1
ignit. coil (primary signal)

TD signal from ignition
trigger box.



280/0831

Return to self-diagnosis
test table B13

C13

<==>

C14

<==>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (6)

SELF-DIAGNOSIS FLASHING CODE 132
Test control-unit voltage supply

Switch off ignition and detach
control-unit plug.

Use ohmmeter to test following lead
for continuity.

Set value: approx. 0 Ω

From control-unit plug term. 9
to main relay term. 87

Is set value attained?

N>

Repair faulty lead.

Is fault still present?
Remove main relay from plug-in
frame.

Connect voltmeter with test prod
to main relay term. 30 (+) and
vehicle ground.

Set value: 8...15 V

If not, use ohmmeter to test leads
for continuity.

Set value: approx. 0 Ω

From main relay term.30 to
battery.

If lead is O.K., renew main relay.

Insert main relay into plug-in
frame.

Connect voltmeter with test prod
to main relay term. 85 (+) and
vehicle ground.

Set value: 8...15 V

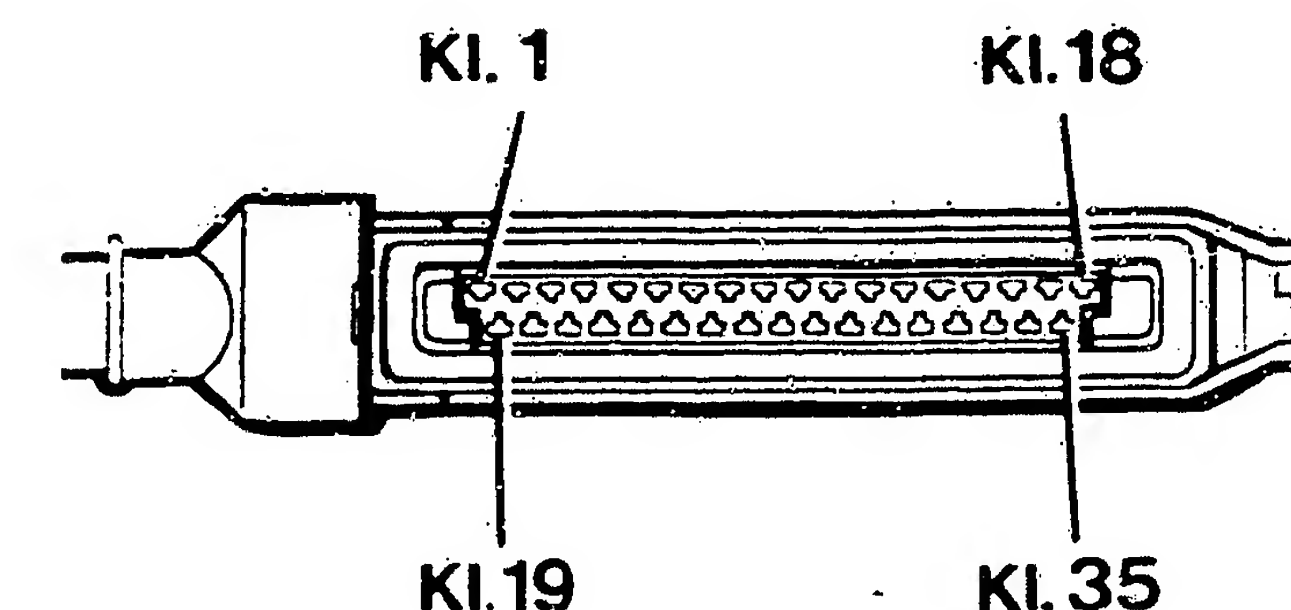
If not, test leads for continuity
with ohmmeter.

Set value: approx. 0 Ω

From main relay term. 86 to
battery.

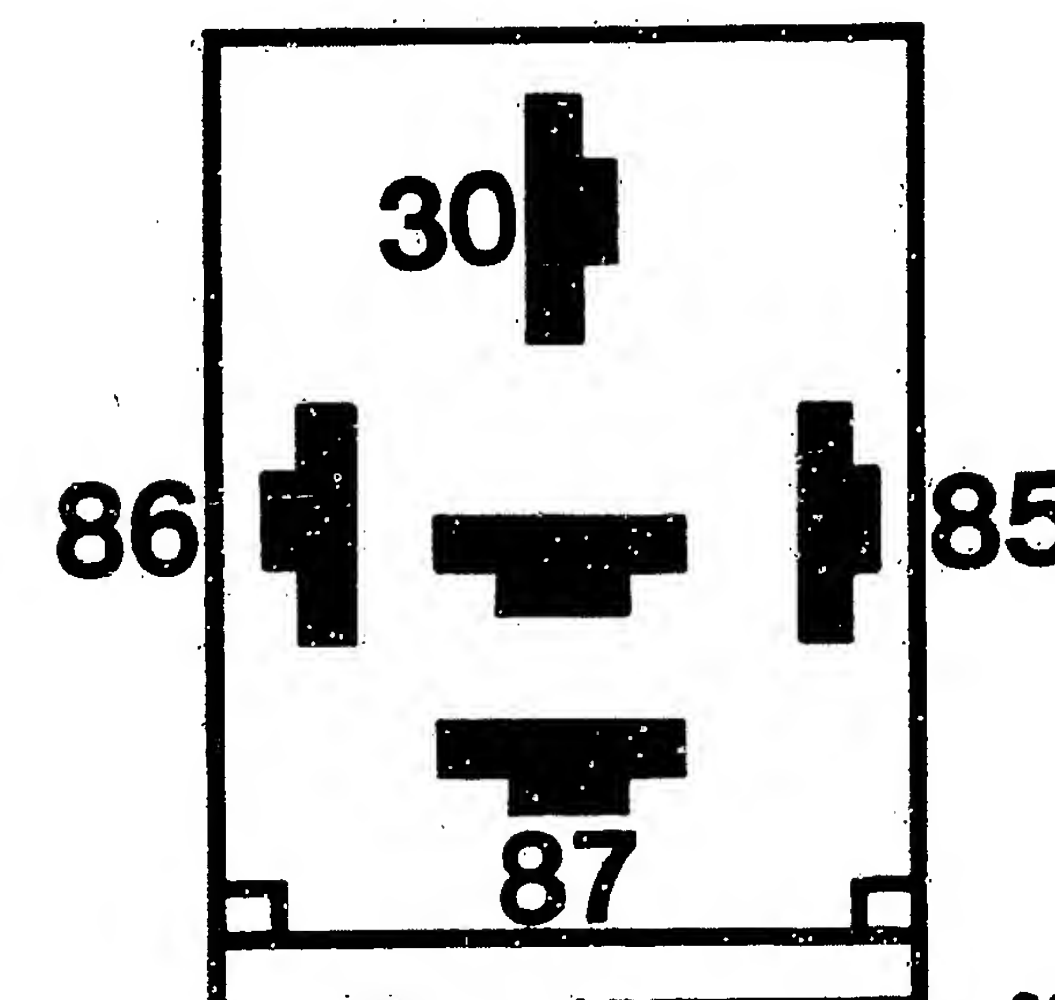
From control-unit plug term. 21
to main relay term. 85

If leads are O.K., renew main
relay.



227/925

Top view of connection
base.



280/0936

Return to self-diagnosis
test table B15

C15

<=>

C16

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (7)

SELF-DIAGNOSIS FLASHING CODE 133

Test throttle-valve-switch idle contact.

Detach plug at throttle-valve switch.
Connect ohmmeter to throttle-valve switch term. 2 and term. 18.

Set values:

Throttle valve closed: 0 Ω
Throttle valve open: infinity Ω

Are set values attained?

N>

Trouble-shooting:

Prerequisite: throttle valve is correctly set.

Lever must make contact with adjusting screw shortly prior to end position.

Secure against turning.

- * Set accelerator cable/linkage such that there is no tension.
- * If kinked => renew.

Adjustment of throttle-valve switch

Loosen fastening screws somewhat.
Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch until idle contact makes (microswitch is heard to click). Reading 0 Ω . If not => renew throttle-valve switch.

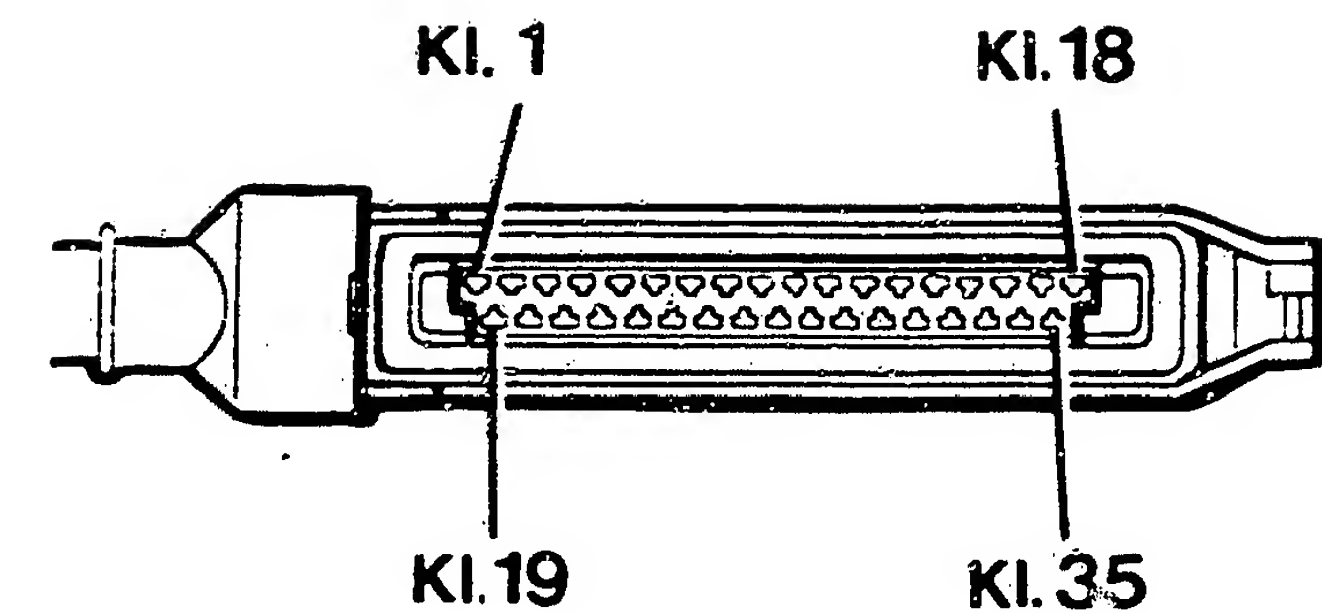
Adjustment check:

Tighten accelerator cable somewhat. The idle contact opens (microswitch is heard to click). Reading: infinity Ω .

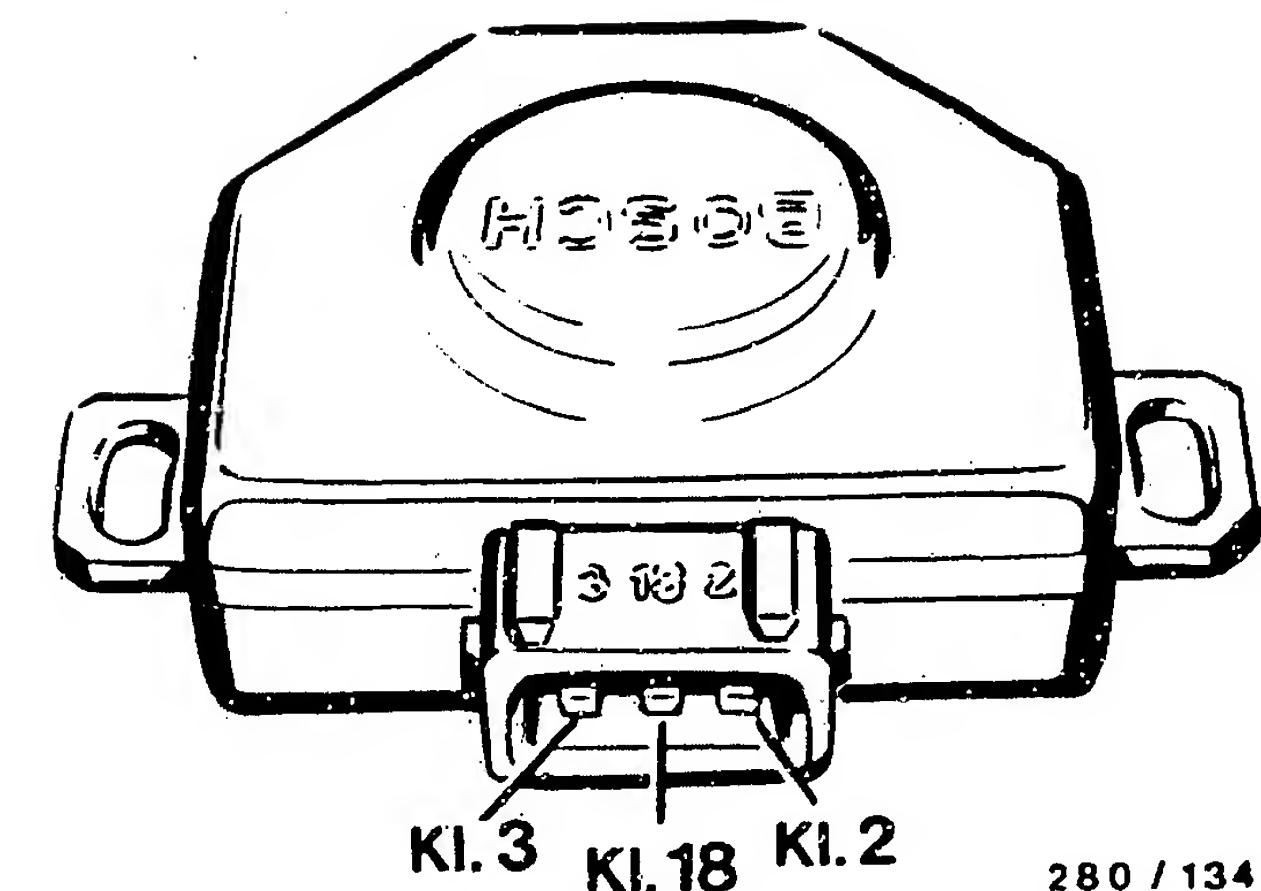
Use ohmmeter to check following leads for continuity

Set value approx. 0 Ω :

- * From throttle-valve switch term. 2 to control-unit plug term. 2
- * From throttle-valve switch term. 18 to vehicle ground. Eliminate open-circuits/contact resistances.



227/925



280 / 1347

Return to self-diagnosis test table B15

C17

<=>

C18

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (8)

SELF-DIAGNOSIS FLASHING CODE 212

Test lambda sensor

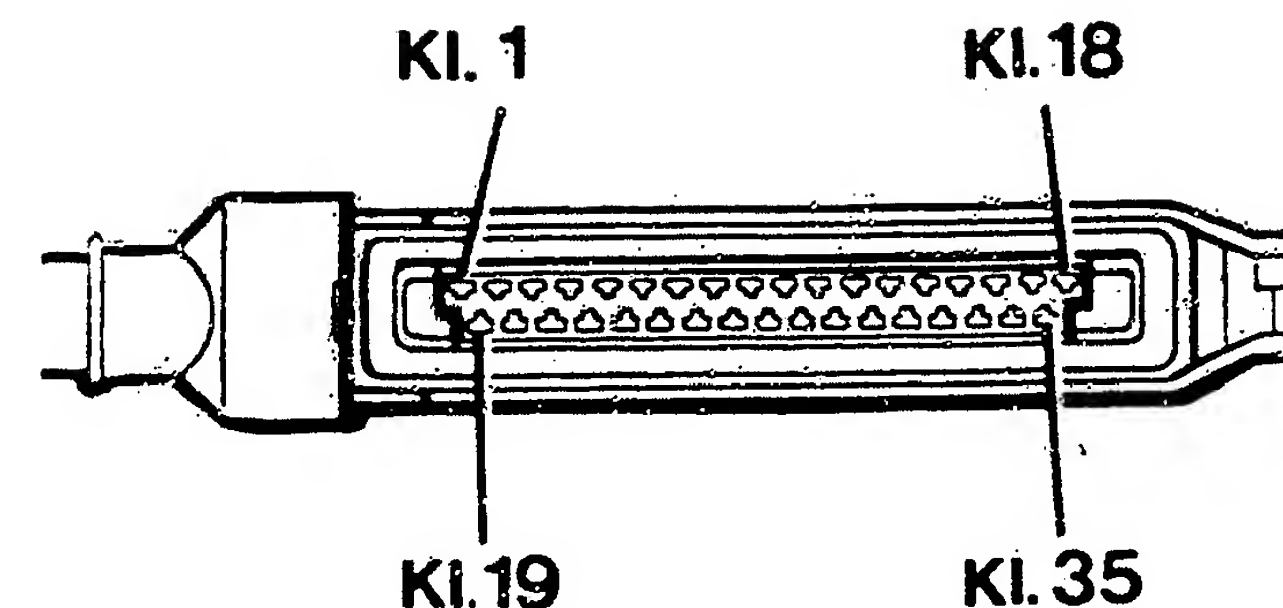
Disconnect plug connection of lambda sensor.
Use ohmmeter to test following leads for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 24 to plug connection.
From heater plug to pump relay term. 87.
From heater plug to vehicle ground.
From sensor housing to vehicle ground.

Is set value attained?

N>

Repair defective lead/plug.



227/925

Renew lambda sensor.

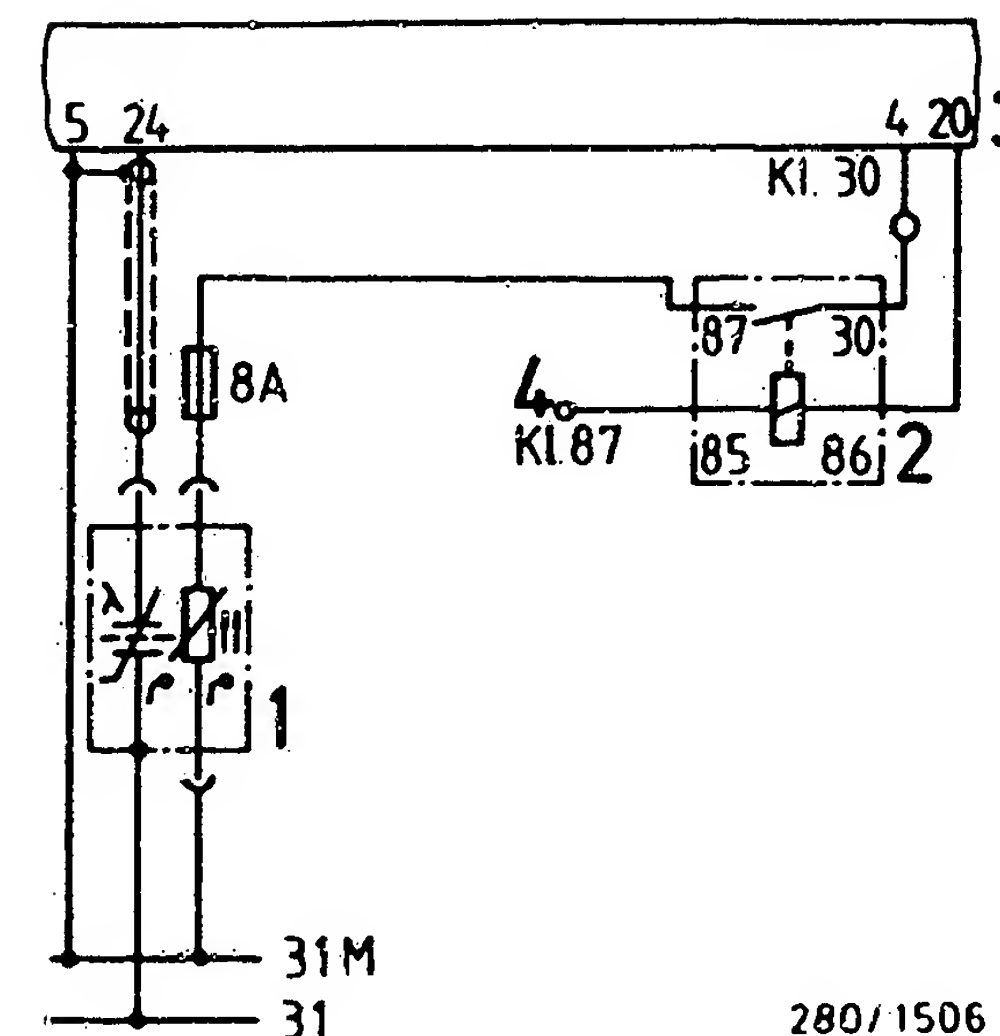
Is fault now no longer present?

N>

Replace control unit

Return to self-diagnosis test table B15

- 1 = Lambda sensor with heater
- 2 = Pump relay
- 3 = Control-unit plug
- 4 = to main relay



280/1506

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (9)

SELF-DIAGNOSIS FLASHING CODE 213

Test throttle-valve-switch
full-load contact.

Detach plug at throttle-valve
switch.
Connect ohmmeter to throttle-valve
switch term. 3 and term. 18.

Set values:
Throttle valve
closed: infinity Ω
Throttle valve fully
open: approx. 0 Ω

Are set values attained?

N>

* Resistance remains continuously
on 0 Ω (full-load contact does
not open):
Renew throttle-valve switch.

* Full-load contact does not make
(reading remains constantly on
infinity Ω):
Test whether throttle valve can
be fully opened by mechanical means.
If mechanical system is O.K.,
renew throttle-valve switch.

N o t e :
Full-load contact cannot be
adjusted. If idle contact is
correctly set, the setting of the
full-load contact is likewise
correct.

Repair defective lead/plug.

Use ohmmeter to test following leads
for continuity.
Set value: approx. 0 Ω

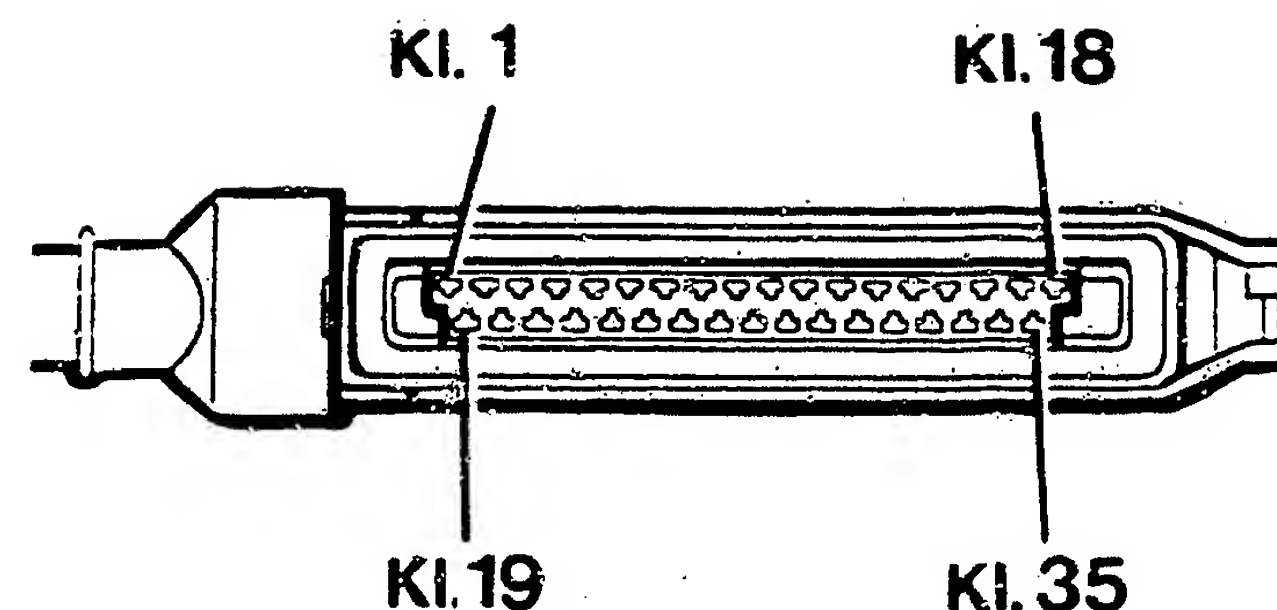
From control-unit plug term. 3
to throttle-valve switch term. 3.

From throttle-valve switch
term. 18 to vehicle ground.

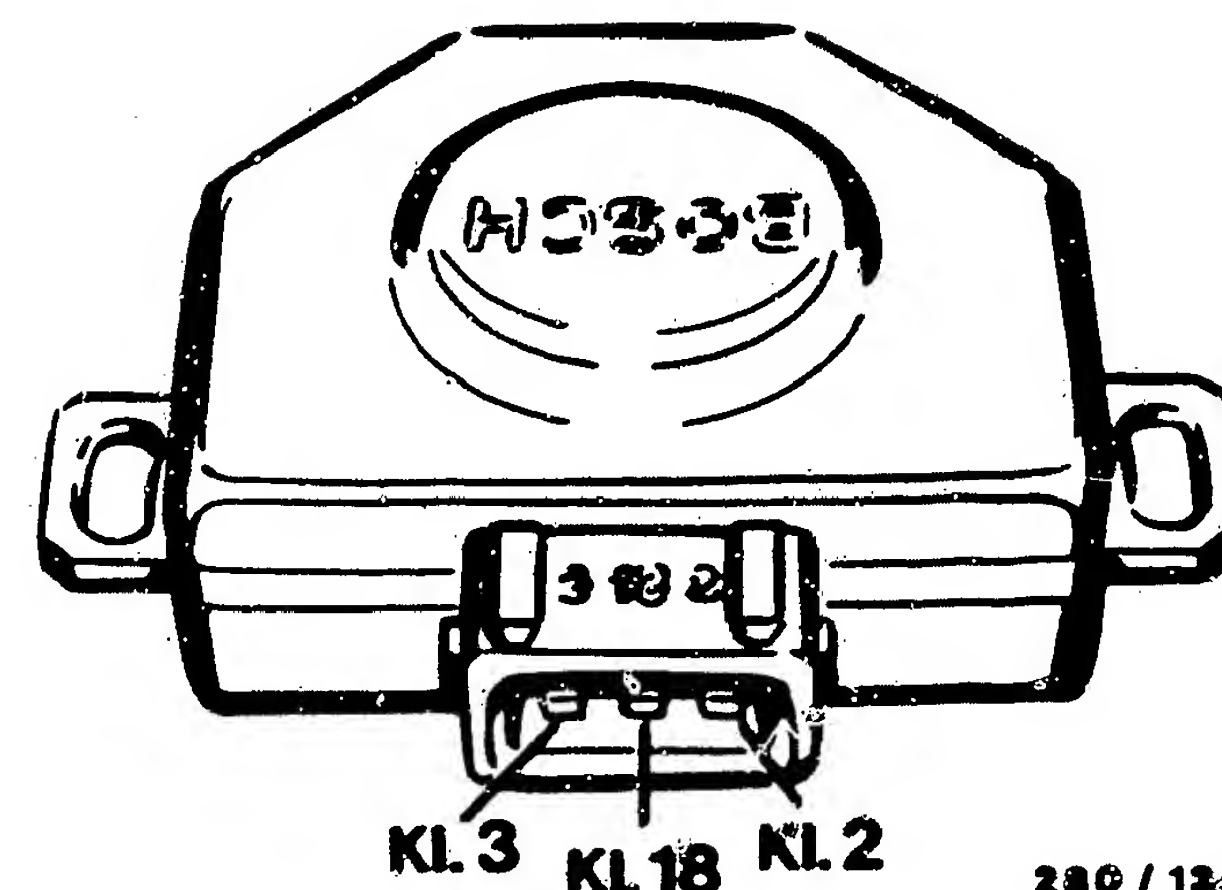
Watch out for worn cable insulation
and loose contacts.

Is set value attained?

N>



227/925



280/1247

Return to self-diagnosis
test table B15

C21

<=>

C22

<=>

V

SELF-DIAGNOSIS FLASHING CODE 221

N>

Lambda closed-loop control not within working range (rich or lean stop).

Possible sources of fault:

- * No or incorrect functioning of lambda closed-loop control, short-circuit in lambda-sensor lead to positive or ground.
- * Fuel pressure/delivery of electric fuel pump
- * Leak in air intake system or exhaust system.
- * Tank ventilation valve(s) always open.
- * Defective injection valves
- * Hot-wire air-mass meter
- * Tank run empty

Stated items O.K.?

Y
V

Continued on next picture page

Test lambda closed-loop control function of control unit:

Connect CO analyzer to sampling ahead of catalytic converter.
Disconnect negative terminal of battery and reconnect after 1 minute (operation serves to clear adaption values from control unit).

Disconnect connector of lambda sensor (arrow, lower picture).
Start engine and allow it to idle.

Measure CO content.
Set value: see brief instructions

Is set value attained?

N>

CO CONTENT TOO HIGH

Use ohmmeter to test following lead for short-circuit to ground.
Set value: infinity Ω

From control-unit plug term. 24 to control-unit plug term. 5.

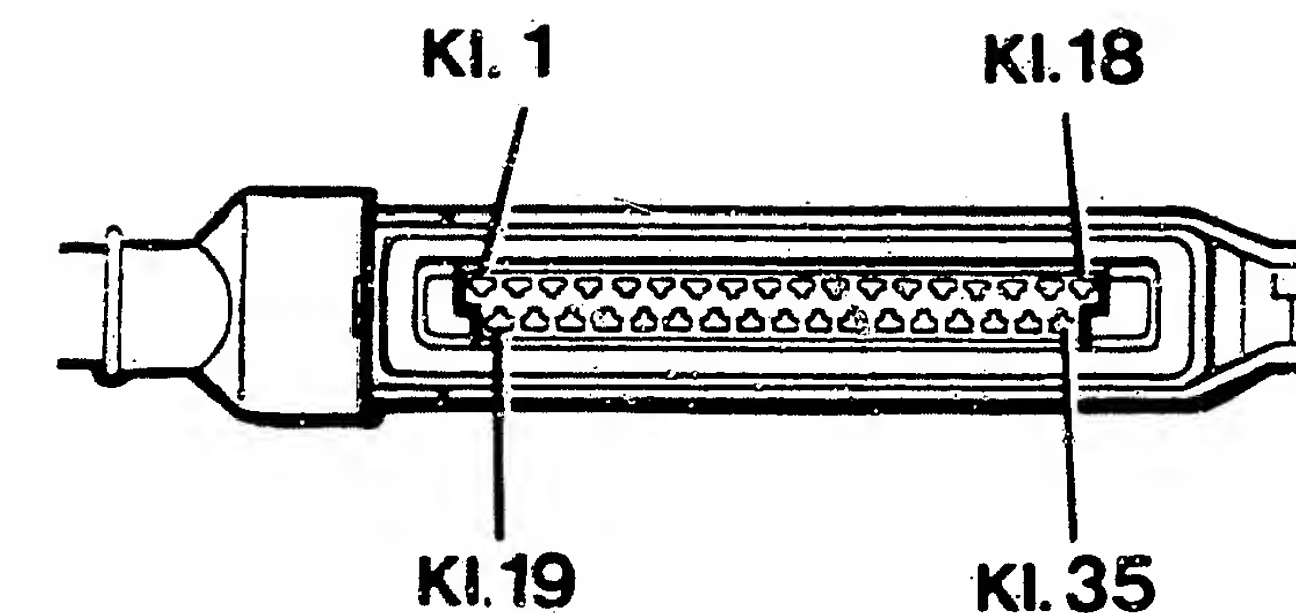
If set value is attained, renew control unit.

CO CONTENT TOO LOW

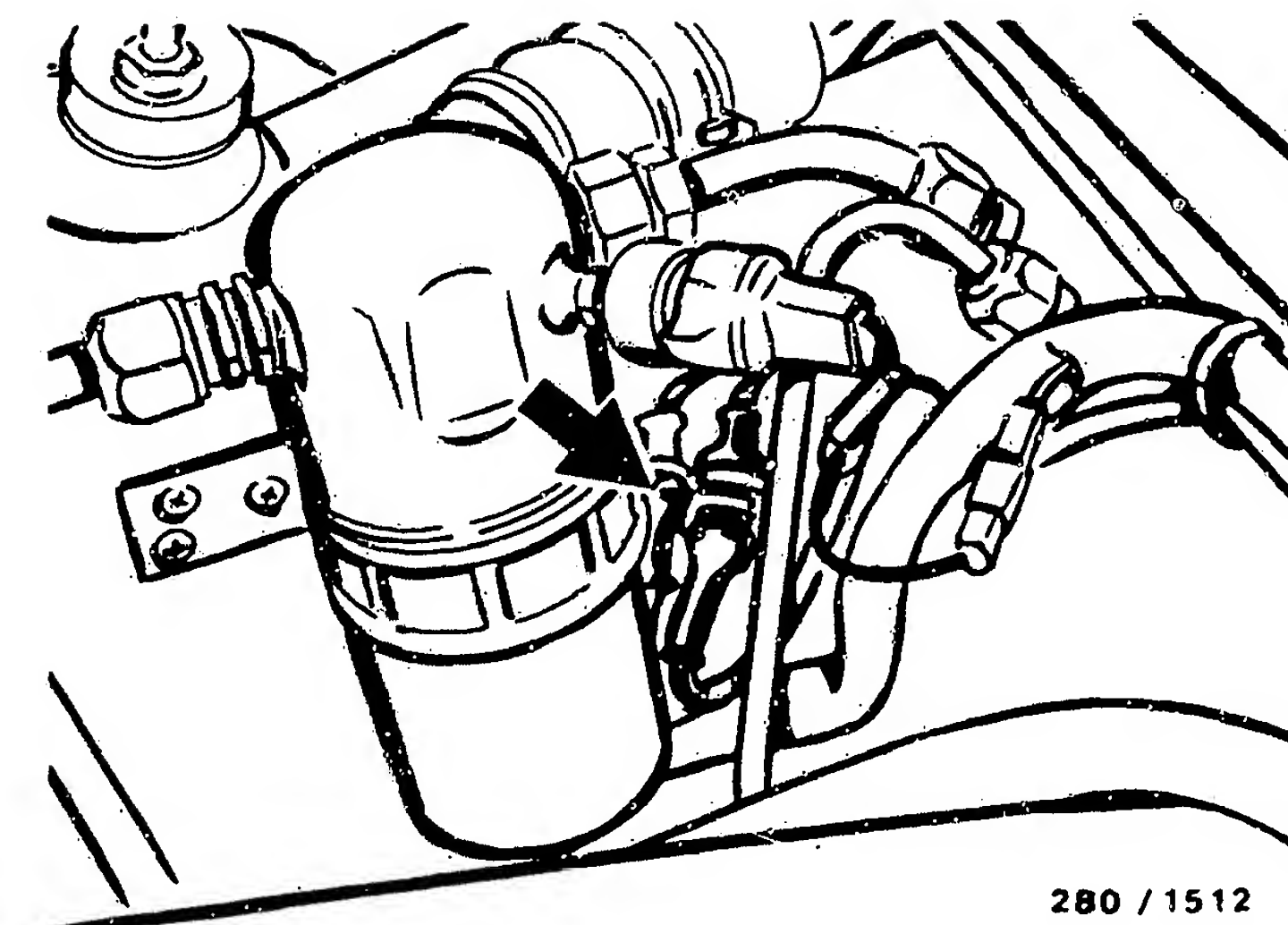
Use ohmmeter to test following lead for short-circuit to U Bat .

From control-unit plug term. 24 to control-unit plug term. 4.

If set value is attained, renew control unit.



227/925



280 / 1512

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (2)

Test closed-loop control function
of control unit.

Run engine at idle speed.

Hold lambda-sensor lead to control
unit against vehicle ground.

Set value: CO content increases.

Hold lambda-sensor lead to control
unit against positive terminal of
1.5 V battery and negative terminal
of battery against vehicle ground.

Set value: CO value decreases.

Are set values attained?

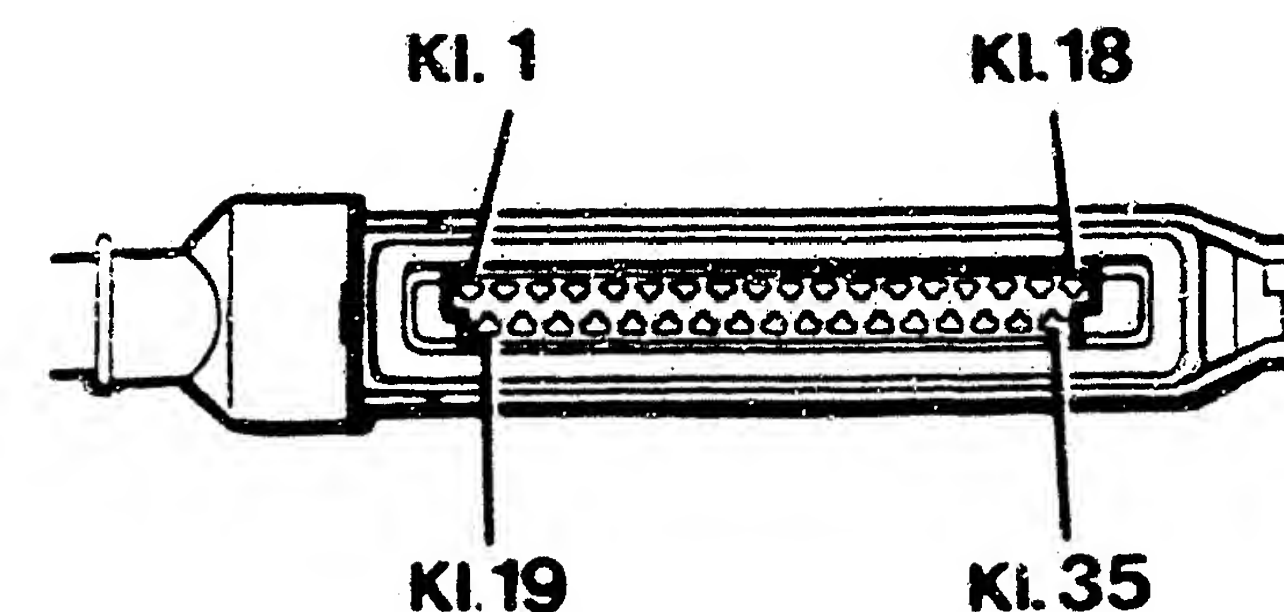
N>

Use ohmmeter to test following lead
for continuity.

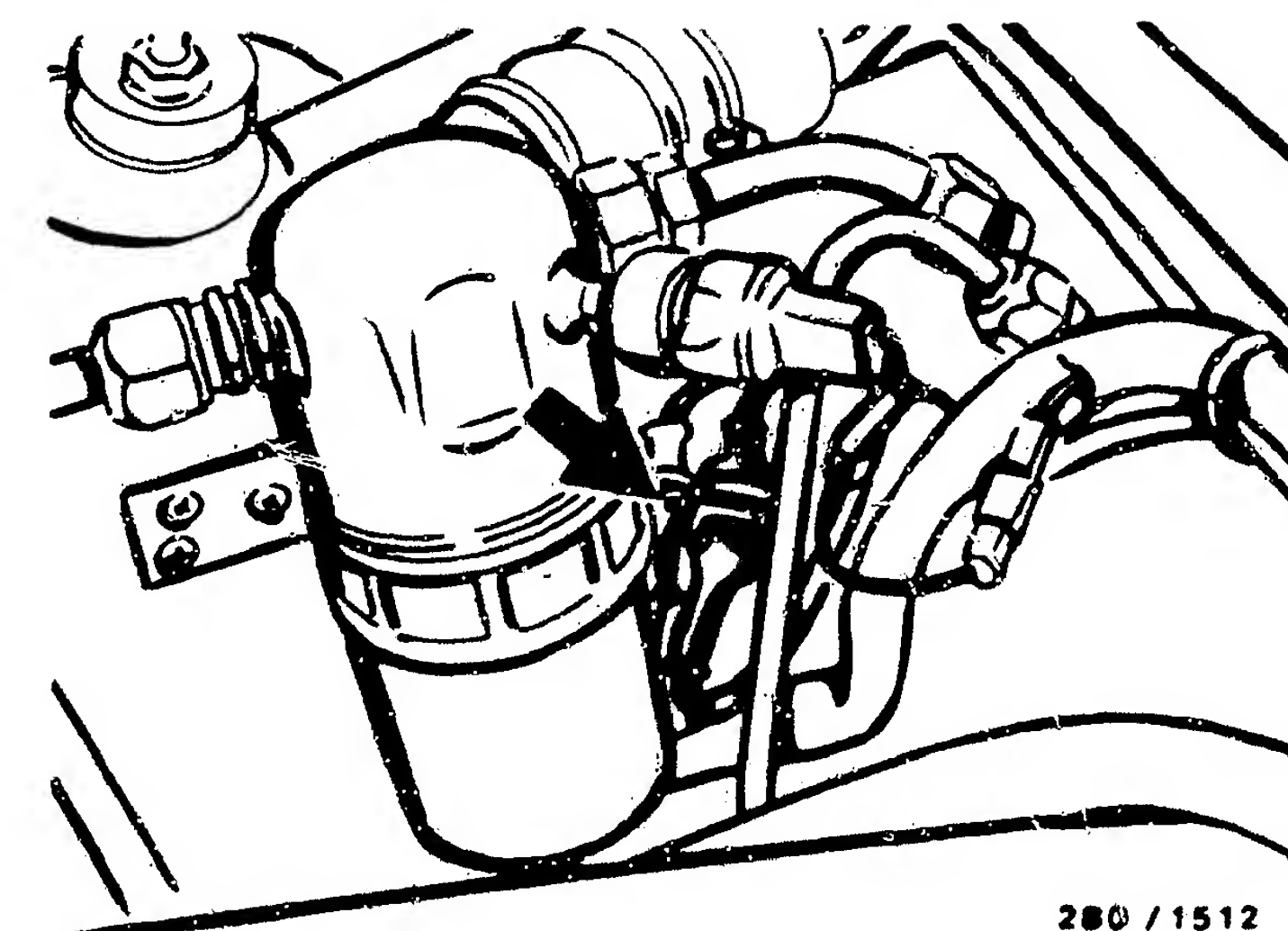
Set value: approx 0 Ω

From control-unit plug term. 24
to plug connection of lambda
sensor.

If lead is O.K., renew control unit.



227/925



280/1512

Continued on next picture page

Test lambda sensor.

Connect plug connection of lambda sensor.

Start engine, run it up to operating temperature (approx. 80° C) and allow it to idle.

Connect CO analyzer to sampling point ahead of catalytic converter.

Measure CO content.

Set value: see brief instructions

Is set value attained?

N>

Set CO content with CO adjustment potentiometer at hot-wire air-mass meter.

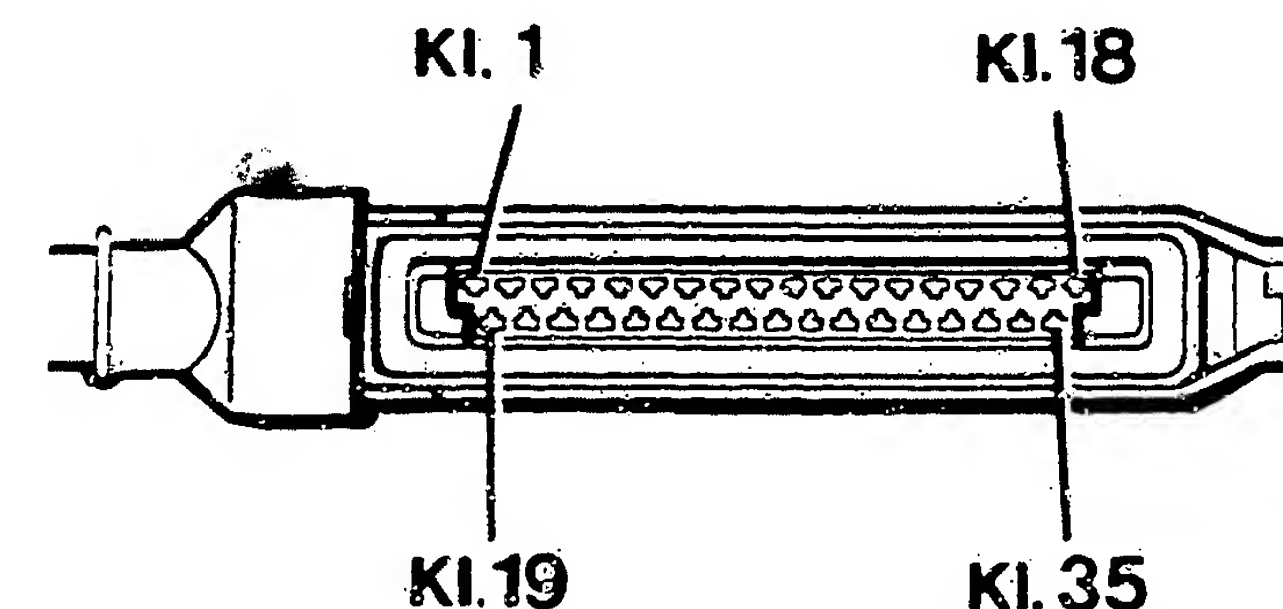
Set value: see brief instructions

If CO content cannot be adjusted, renew lambda sensor.

If there is no CO adjustment potentiometer, renew lambda sensor.

Note: Prior to installing, coat thread of lambda sensor with mounting paste VS 14016 Ft. Make sure that no paste gets into the slits in the protective conduit.

Part number of mounting paste:
5 964 080 112.



227/925

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (4)

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.

Disconnect pump relay.

Connect jumper into connection base between term. 87 and term. 30.

The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery

SET VALUE: See brief instructions

Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Continued on next picture page

*Fuel filter very dirty
→ replace.

*Fuel delivery line or pressure damper (if applicable) clogged → replace.

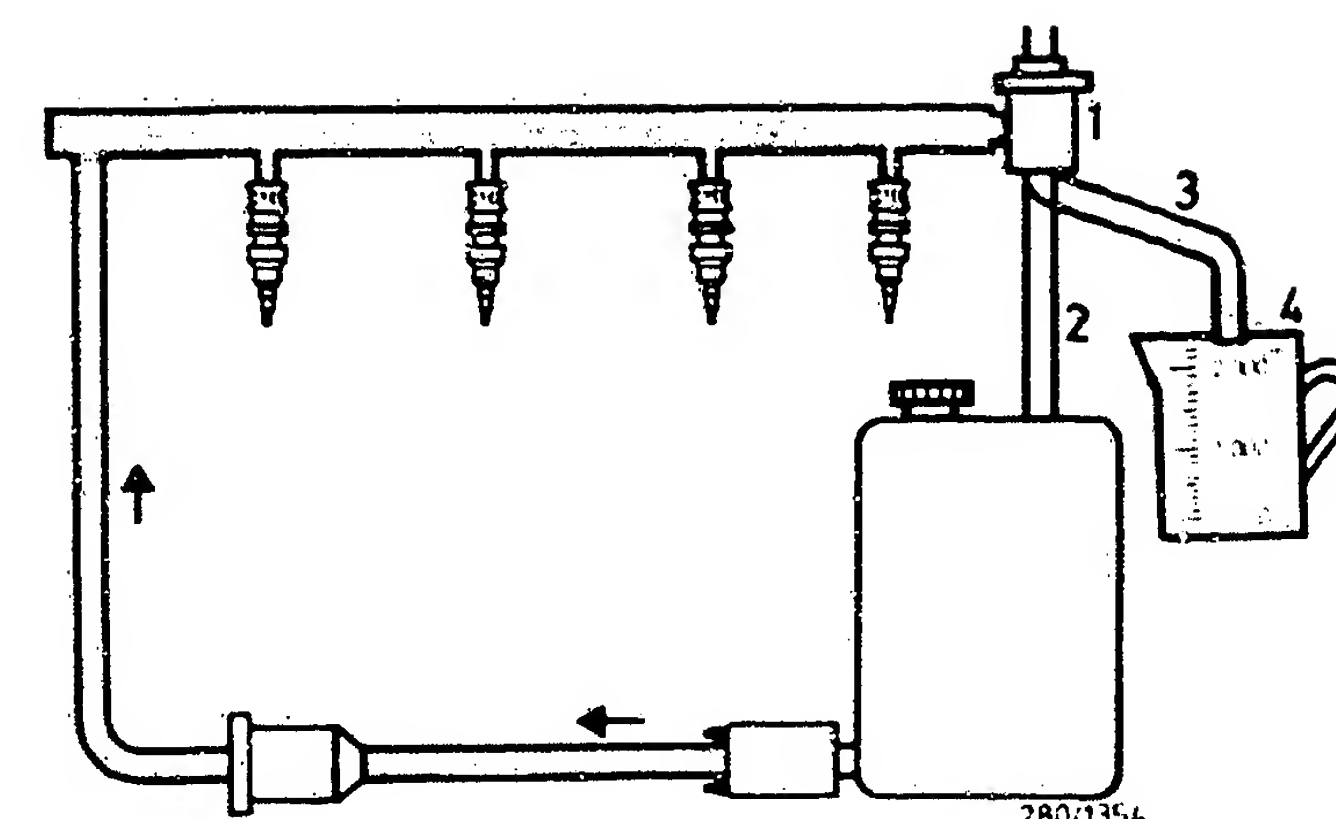
*Voltage at electric fuel pump, with engine running, min. 12 V. If not, clean contacts, eliminate poor ground connection, replace leads.

*Check pre-supply pump (if applicable). Measuring point: line between the pumps. Fuel delivery must be at least 10% greater than that of the electric fuel pump. If not → replace pre-supply pump.

*If fuel-pump delivery too low → replace electric fuel pump. Clean joints before loosening so that no dirt gets into the fuel system. In-tank electric fuel pumps are accessible via a closure on the tank.

*If electric fuel pump loud (vapor locks) intake line constricted or kinked → replace. Strainer in tank clogged → replace. Corrosion in tank → clean/replace.

*Pressure regulator defective - check. See next coordinate:



————— Pressureless

||||||| Fuel pressure

1 = Pressure regulator

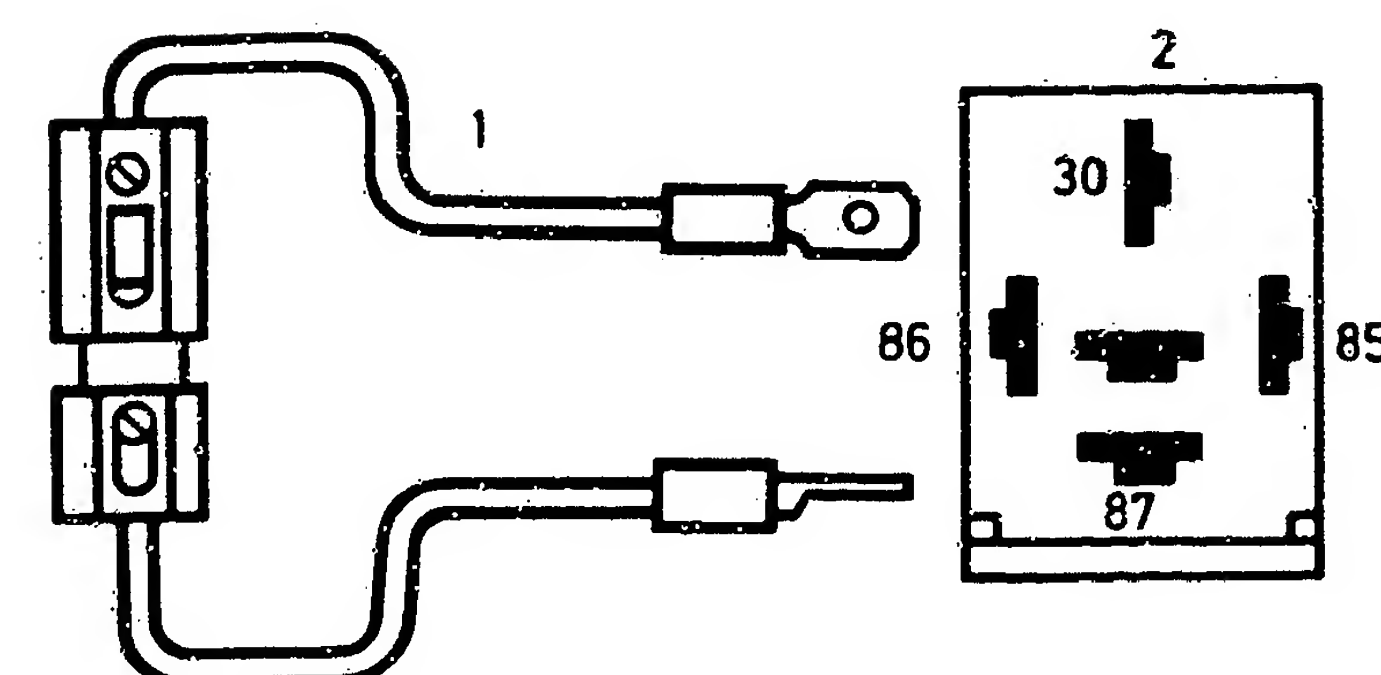
2 = Return

3 = Test hose

4 = Measuring glass

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



Check fuel pressure with engine stopped.

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

CAUTION!

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5). Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

N>

Set value not reached:

*Slowly pinch off fuel return line. Caution! Do not allow pressure to exceed 6 bar.

*Renew pressure regulator if pressure exceeds 5 bar.

Use new O-rings in the case of O-ring sealing technique.

Apply a small quantity of engine oil (e.g. HD 30).

If pressure does not increase sufficiently: fuel pump defective, renew.

*Fuel filter heavily contaminated, renew.

*Fuel delivery line or pressure damper (if provided) clogged, renew.

*Strainer in tank clogged. Corrosion in tank.

Set value exceeded:

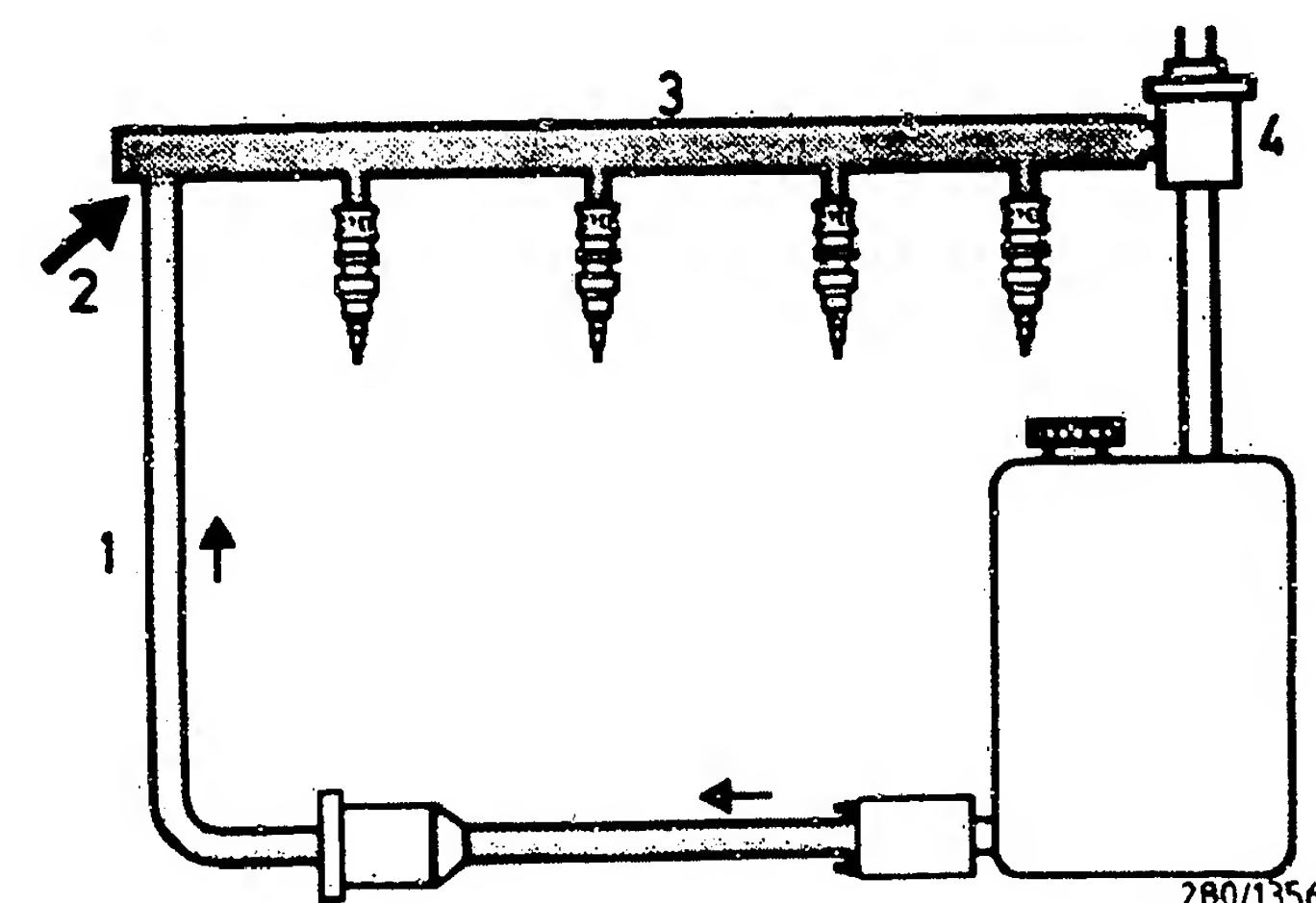
Detach fuel return hose from pressure regulator.

Attach test hose to pressure regulator and route it into a 1.5l measuring jug.

Is set value now attained?

*If yes, fuel return line clogged or pinched off, renew.

*If not, pressure regulator defective, renew.



Pressureless

Fuel pressure

1 = Inlet, delivery line

2 = Measuring point

3 = Fuel-distribution pipe

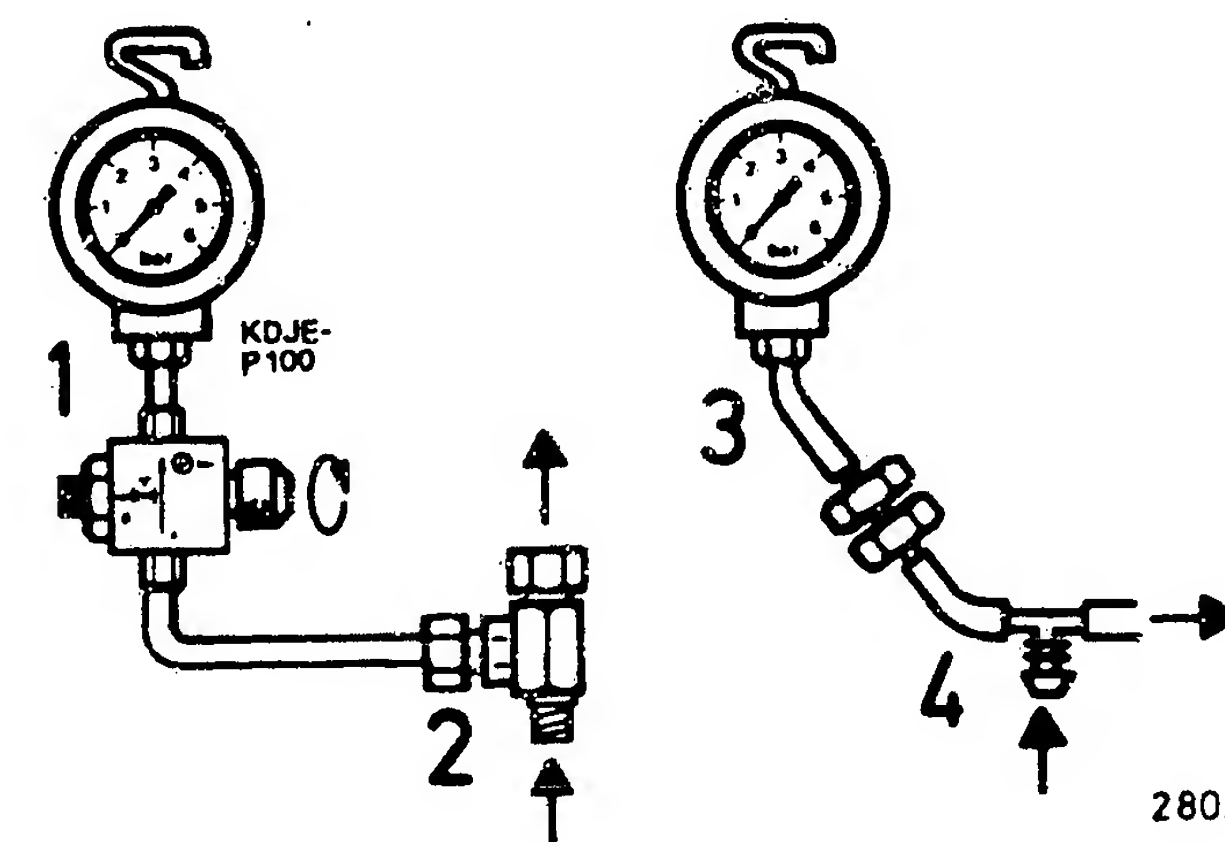
4 = Pressure regulator

1 = Pressure tester

2 = Connec. part KDJE-P100/14

3 = Pressure gauge with hose line

4 = Three-way line KDJE-P100/13



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (6)

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure
SET VALUE: approx. 0.5 bar
lower than with engine stopped.

Set value obtained?

N>

*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking → replace.
Hose line dropped off → re-connect.

*If intake-manifold-pressure energization O.K. → replace pressure regulator.

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure
SET VALUE: min. 1.0 bar
after 20 minutes.

Set value obtained?

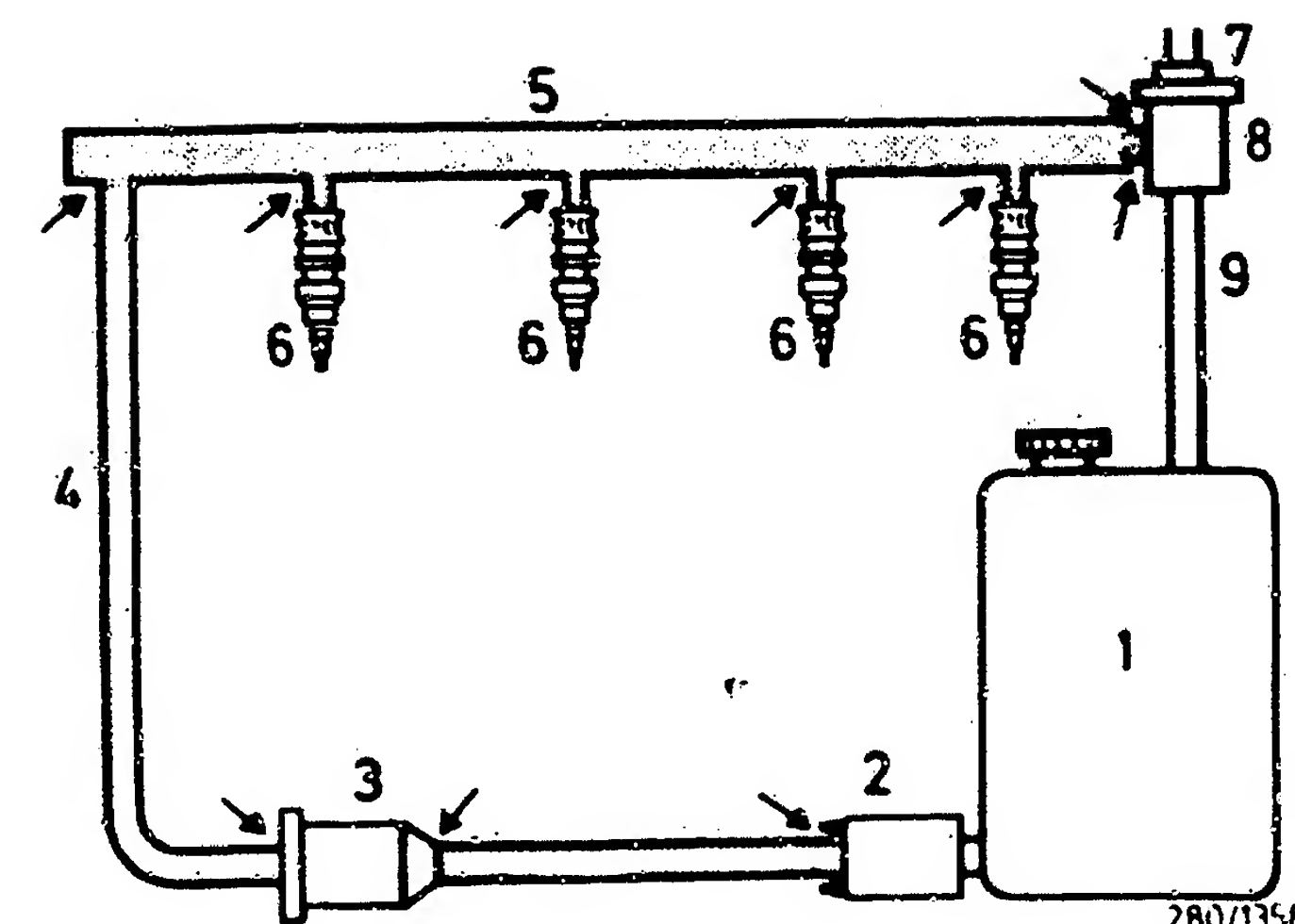
N>

*Leaking at joints between components, fuel hoses and fuel lines → tighten hose binder or replace hose.

*Pressure regulator (diaphragm) leaking → replace.

*Electric fuel pump (non-return valve) leaking.
With screw-type non-return valve → replace.
With integral non-return valve → replace electric fuel pump.

*Pressure damper or fuel filter leaking → replace.



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks

Continued on next picture page

Continued on next picture page

*Leak in injection valve(s)
at point of connection with
fuel distributor; renew
O-ring. See text below.

*Check injection valve(s)
(needle seat) for leaks:

Remove complete fuel distributor.
Supply and return remain
connected. Simultaneously
pull all injection valves
out of intake-manifold guide.

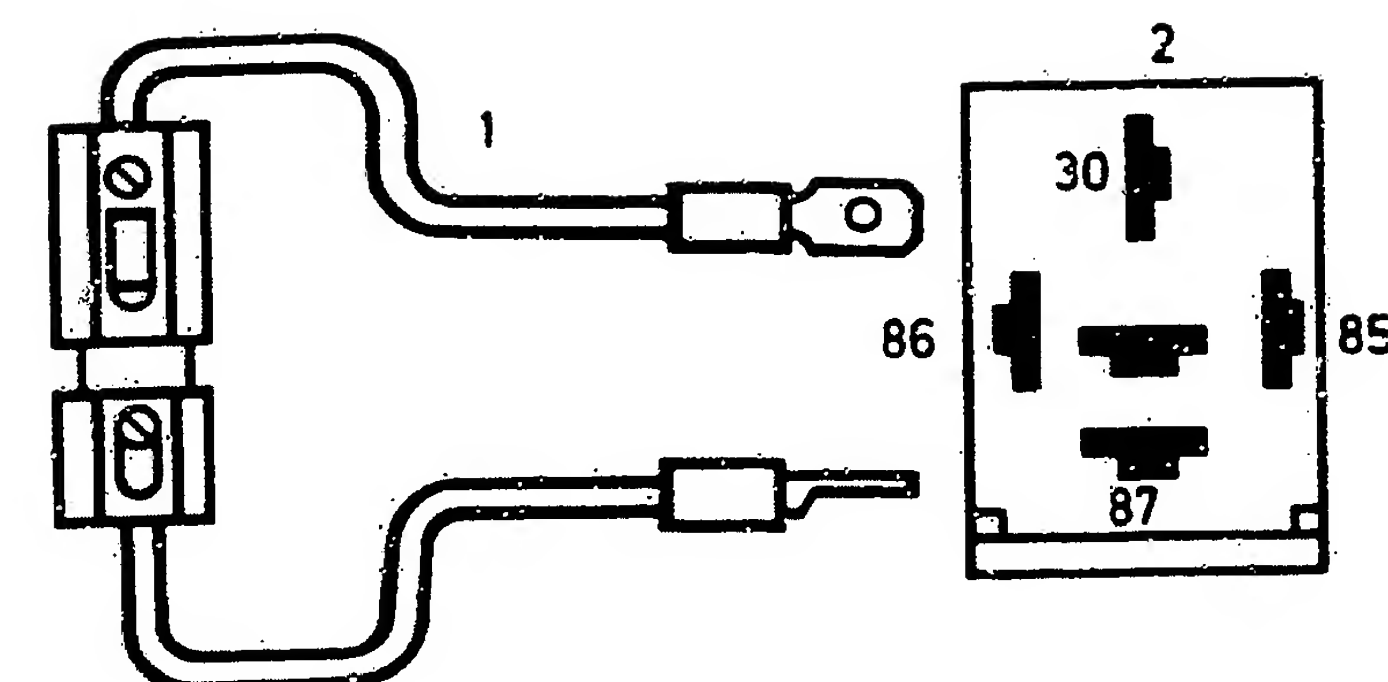
Fit jumper between term. 87
and term. 30 in connection
frame (pump relay).
Electric fuel pump must
run.

Set value:

No droplets may drip off the
injection valve within 60 s.
If they do so, renew injection
valve.

Removal:

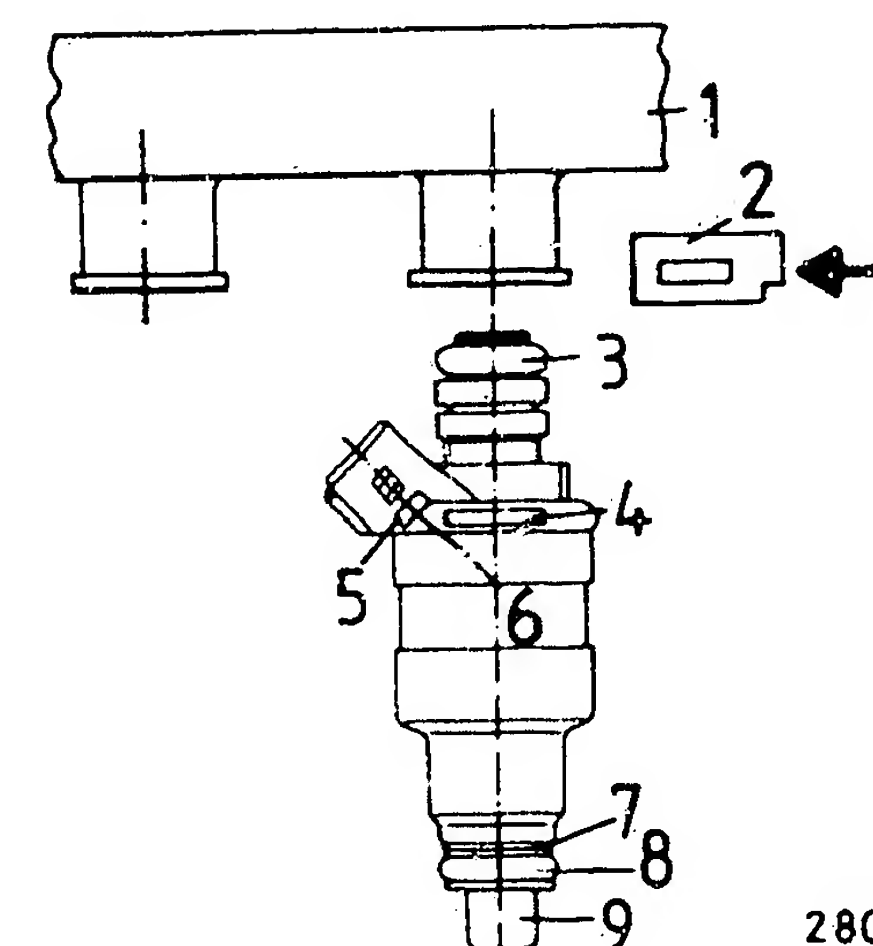
Detach connector.
Pull out retaining clip.
Remove injection valve.
Caution!
Catch any fuel which emerges.
It must not be allowed to make
contact with hot engine components.



280/1359

1 = Jumper with fuse holder
and 10 A fuse (user-
fabricated)
2 = Top view of connection
base

1 = Fuel-distribution pipe
2 = Holding clamp
3 = Upper O-ring
4 = Part number
5 = Date of manufacture
6 = Injection valve
7 = Supporting plate
8 = Lower O-ring
9 = Protective sleeve



280/1360

Continued on next picture page

Continued on next picture page

If there is no injection valve leakage (needle seat), but O-ring is defective, renew O-ring.

Use new parts set.
Caution! Do not damage protective sleeve and valve needle

If upper O-ring (fuel distribution pipe) is damaged, renew it.

If lower O-ring (intake manifold) is defective, cut it up.
Fit new O-ring over protective sleeve and its beading.

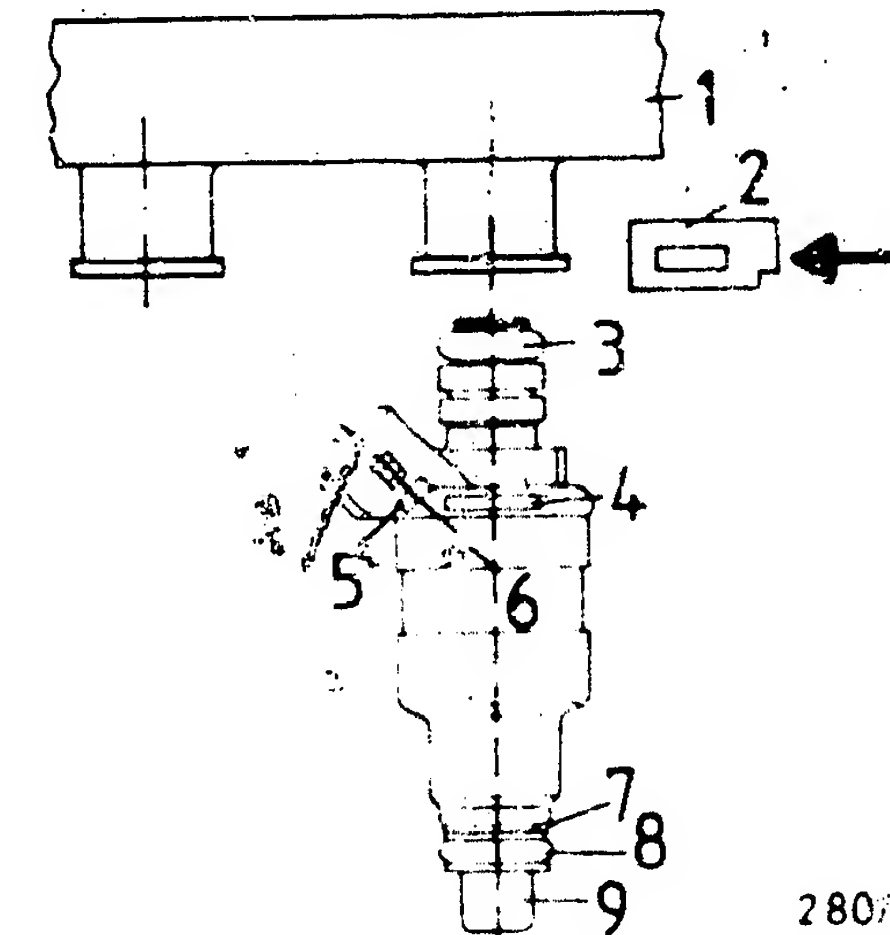
Fitting:
Slightly lubricate O-rings only with engine oil (e.g. HD 30).
Attach injection valve to fuel distribution pipe.
Insert retaining clip into groove and engage it.
Test for fuel leakage.
Attach connector.

Fit complete fuel distribution pipe. In doing so, simultaneously press all injection valves into intake manifold guide.
Important!
Do not damage O-rings or valve needles.
Make sure intake manifold is not leaking.

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.
Connect fuel-inlet hose to fuel-distribution pipe.
Make sure there are no leaks.



280/1360

- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = Date of manufacture
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (9)

Check air-intake system

Are all hoses correctly connected, not kinked or damaged?
Is oil dipstick pressed all the way in? Is lid seal on oil filler neck O.K.?

Are all hoses O.K.?

N>

Replace hoses if necessary.
Re-tighten hose binders.

Push in oil dipstick firmly.
Replace lid seal on oil filler neck.

Y
V

Leak test

Seal tail pipe.
Unscrew air-mass meter from air-filter housing and seal air-mass-meter duct.
Detach hose downstream of idle actuator and seal idle-actuator connection.
Fully open throttle valve.

Use compressed-air gun to blow air (0.3 bar gauge pressure) into intake manifold.
Spray or brush over all seals with leakage detector spray or soapy water.

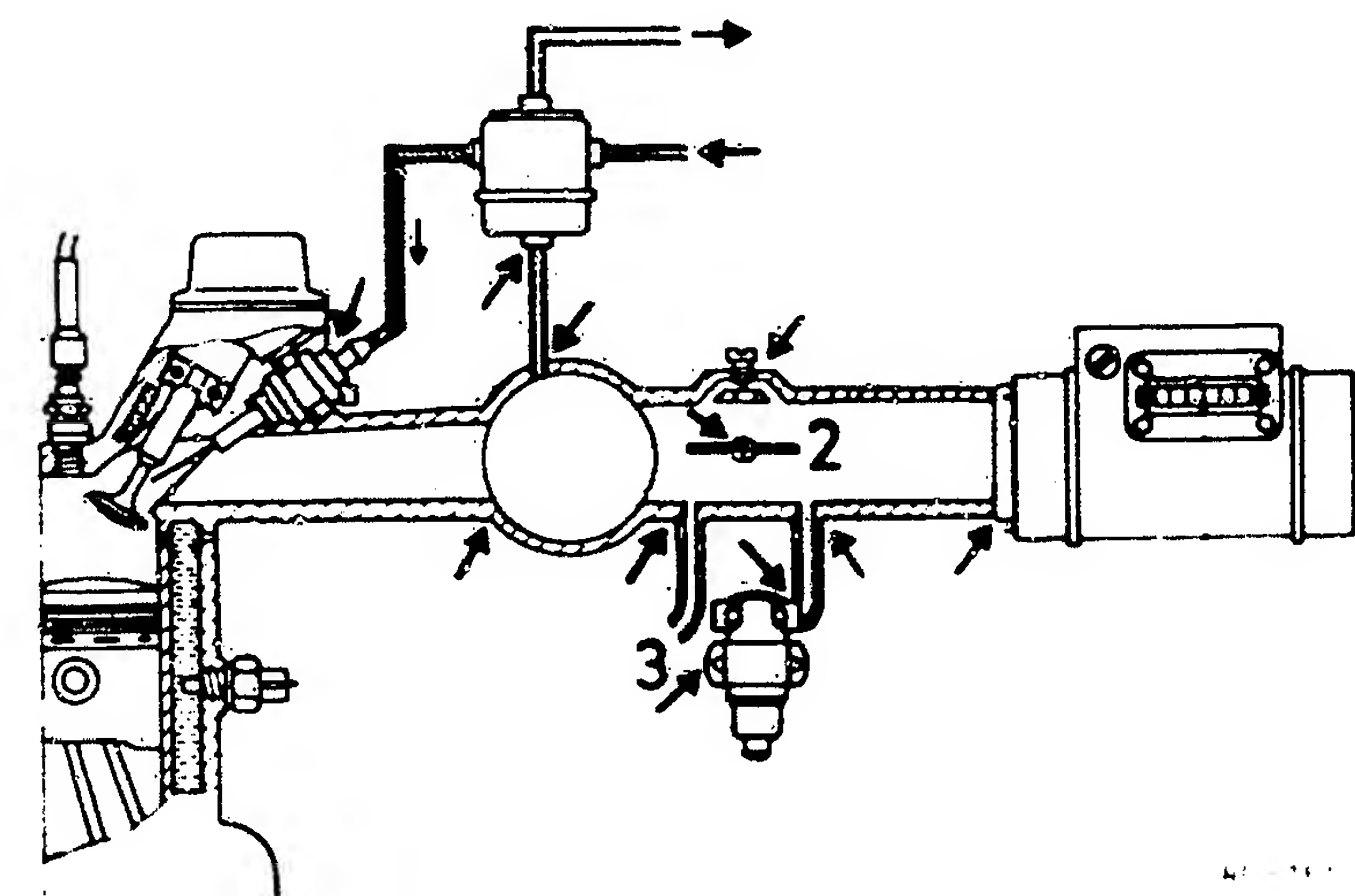
Are all points leakproof?

N>

Bubbling or foaming indicates a leak.

Eliminate leaks by new seals or by re-tightening the hose binders.

Leaks may also occur at the following points:
Throttle-valve mounting, intake-manifold gasket as well as auxiliaries (e.g. brake booster) that work on intake-manifold pressure.



1 = Sealing
2 = Open throttle valve fully
3 = Blow in air
Small arrows = Possible leaks

Continued on next picture page

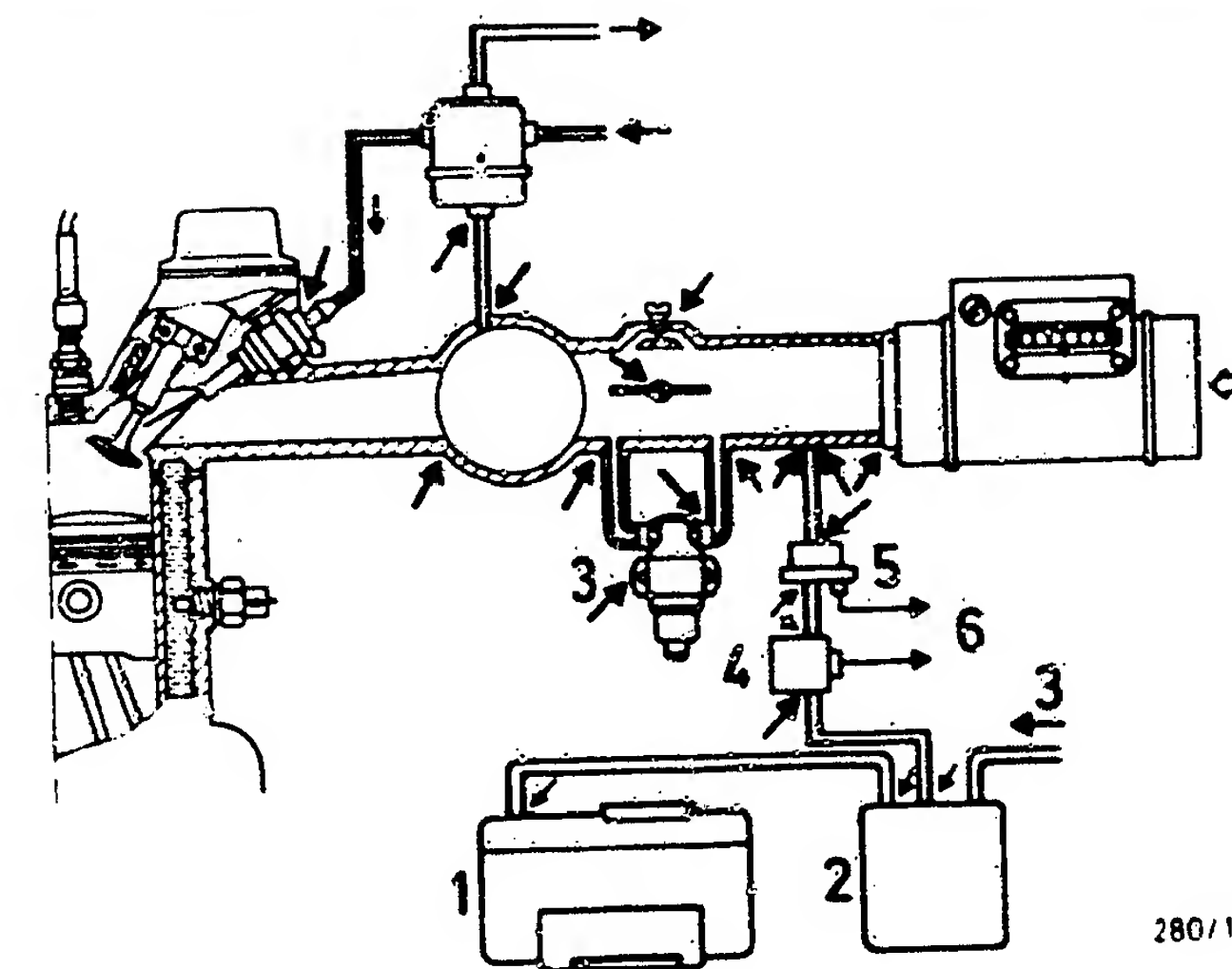
SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (10)

Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

Replace defective hoses as necessary.
Eliminate leakages by tightening hose clamps.



- 1 = Fuel tank
- 2 = Activated-carbon canister
- 3 = Air supply
- 4 = Solenoid-operated valve
- 5 = Tank-ventilation valve
- 6 = Electrical connections

Arrows = possible leakage points

Continued on next picture page

Functional test of tank ventilation valve

Test actuation signal for ACF frequency valve with oscilloscope. To do so, connect 2-pole test lead 1 684 463 093 between tank ventilation valve and its connector.

Connect Motortester (special input) to test lead:
Red pickup to one of the test-lead connections, black pickup to engine ground.

Caution: the free test-lead terminal must not come into contact with ground.

Start engine at operating temperature, part-load operation.

If connection is correct, oscilloscope must indicate pulses corresponding to the adjacent picture (top).

Set value: pulses

Pulses?

N>

Switch off engine and detach control-unit plug as well as tank-ventilation-valve plug.

* Use ohmmeter to test lead from control unit term. 27 to plug of tank ventilation valve term. 1 for continuity.
Set value: 0 Ω

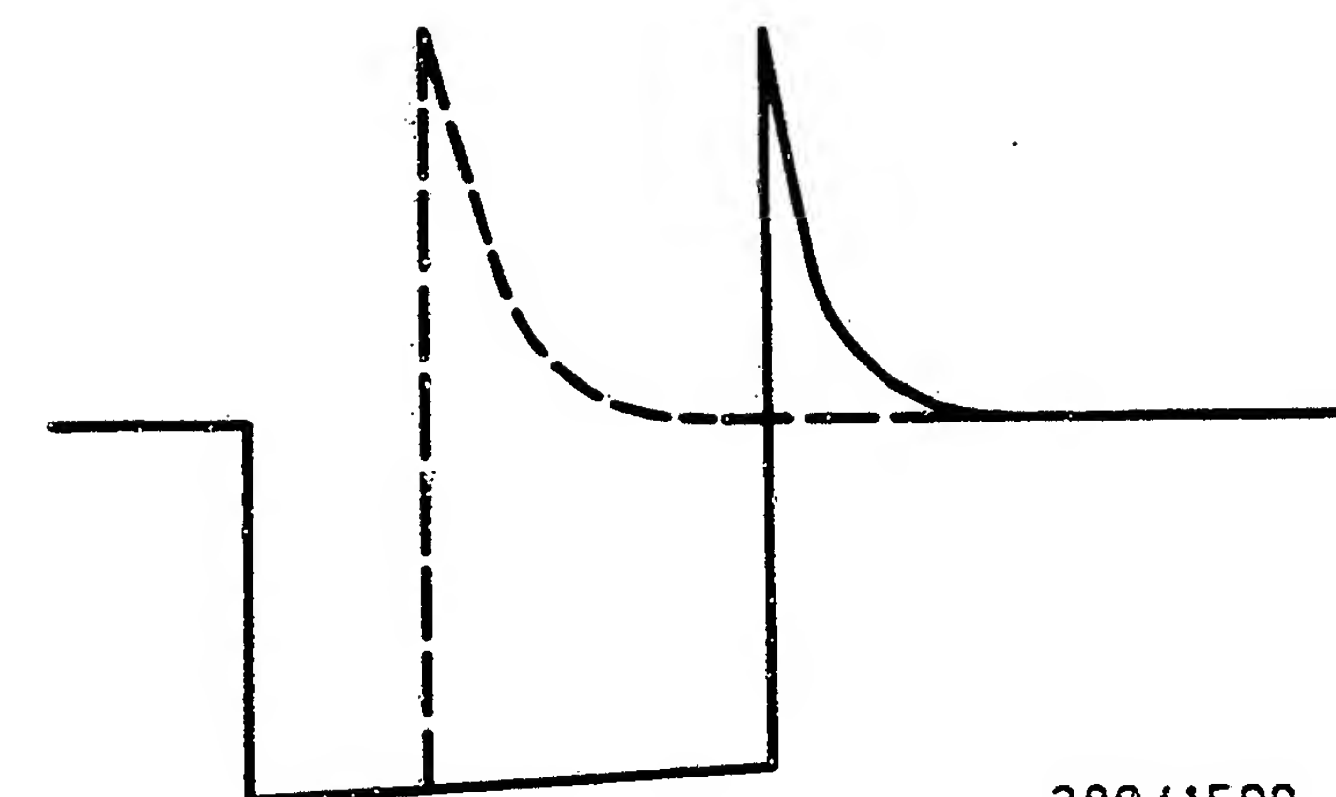
Eliminate any open-circuit.

* Switch on ignition and use voltmeter to test voltage supply at plug of tank ventilation valve term. 2.

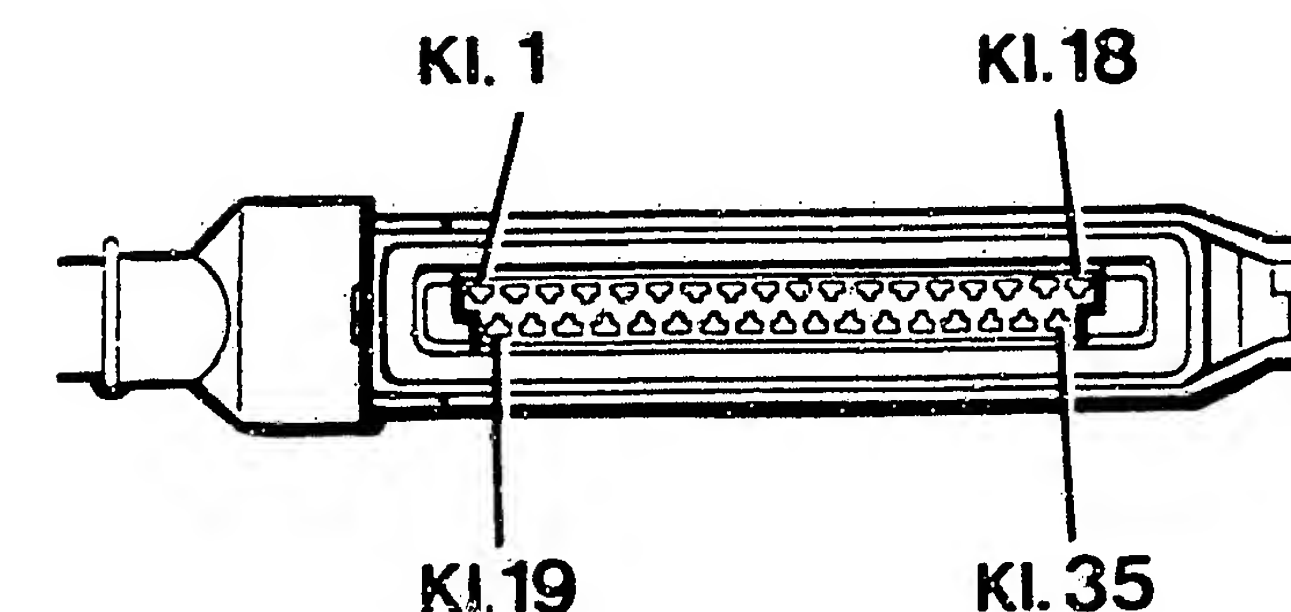
Set value: battery voltage.

Eliminate any interruption in voltage supply from ignition lock via main relay to tank ventilation valve.

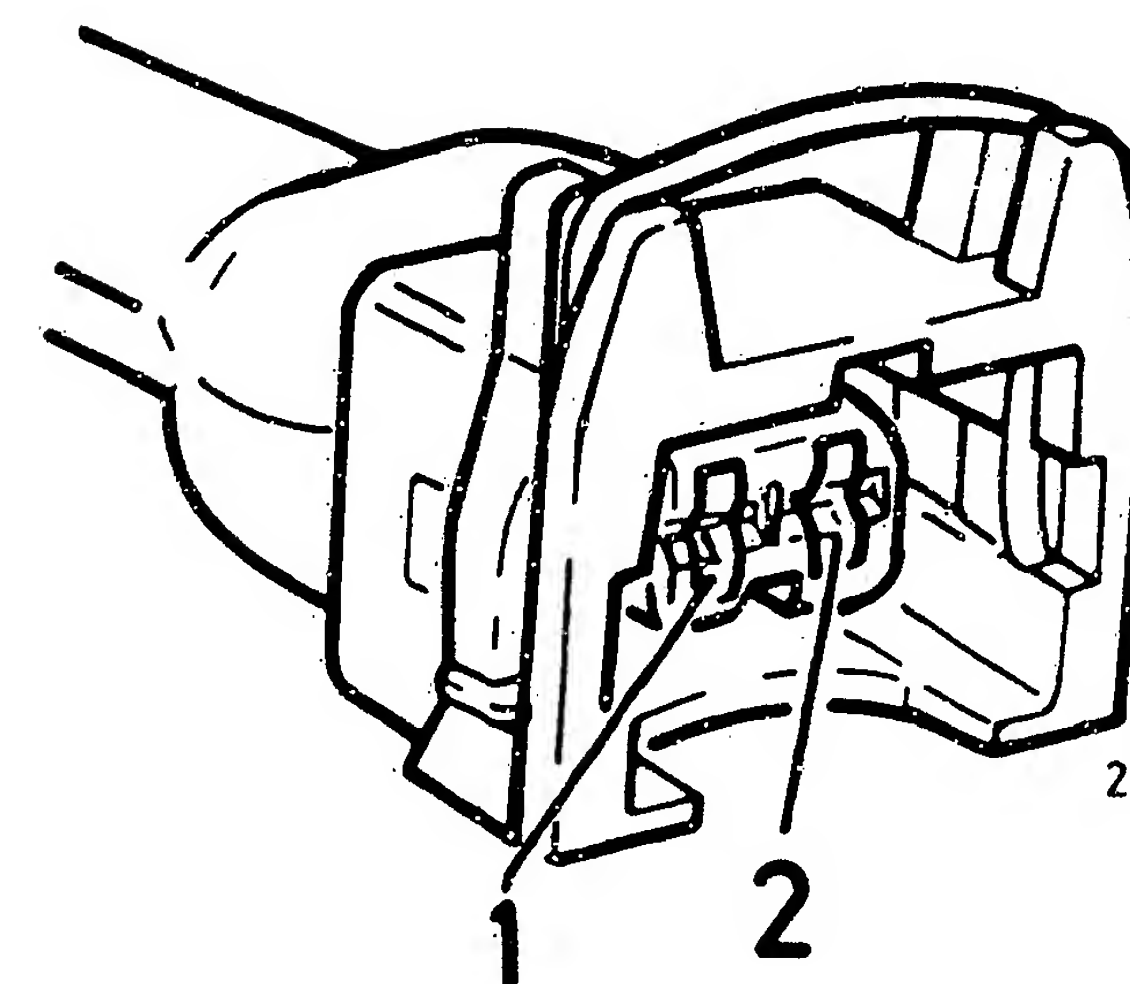
If there is no fault in lead: control unit defective.
Renew control unit.



280/1509



227/925



227/1036

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (12)

Switch off engine and detach connector at tank ventilation valve.

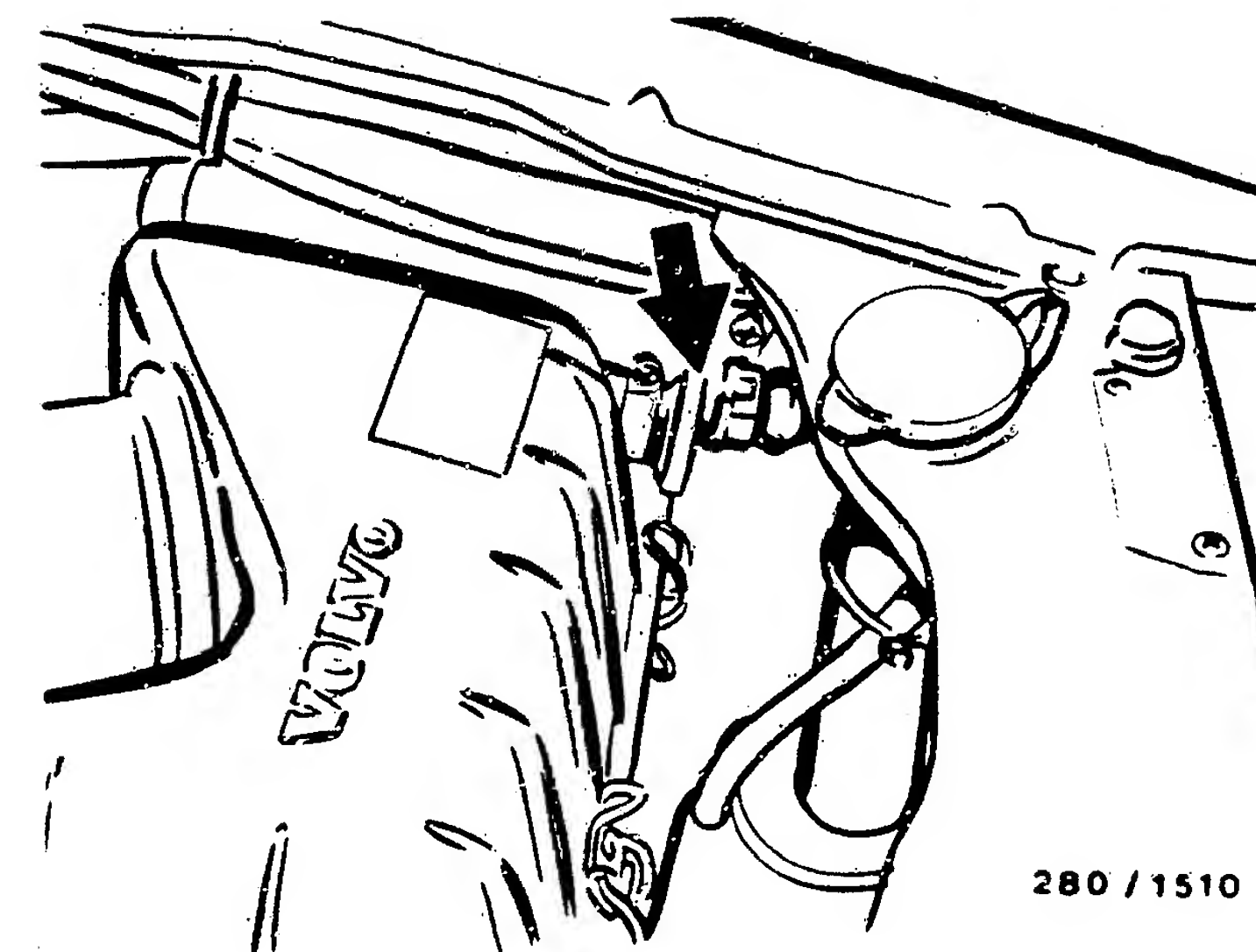
N>

Use ohmmeter to measure internal resistance of valve directly at the two contacts.

Set value: see brief instructions

Is set value attained?

Internal resistance not within tolerance: renew tank ventilation valve.



Testing mechanical switching function of tank ventilation valve:

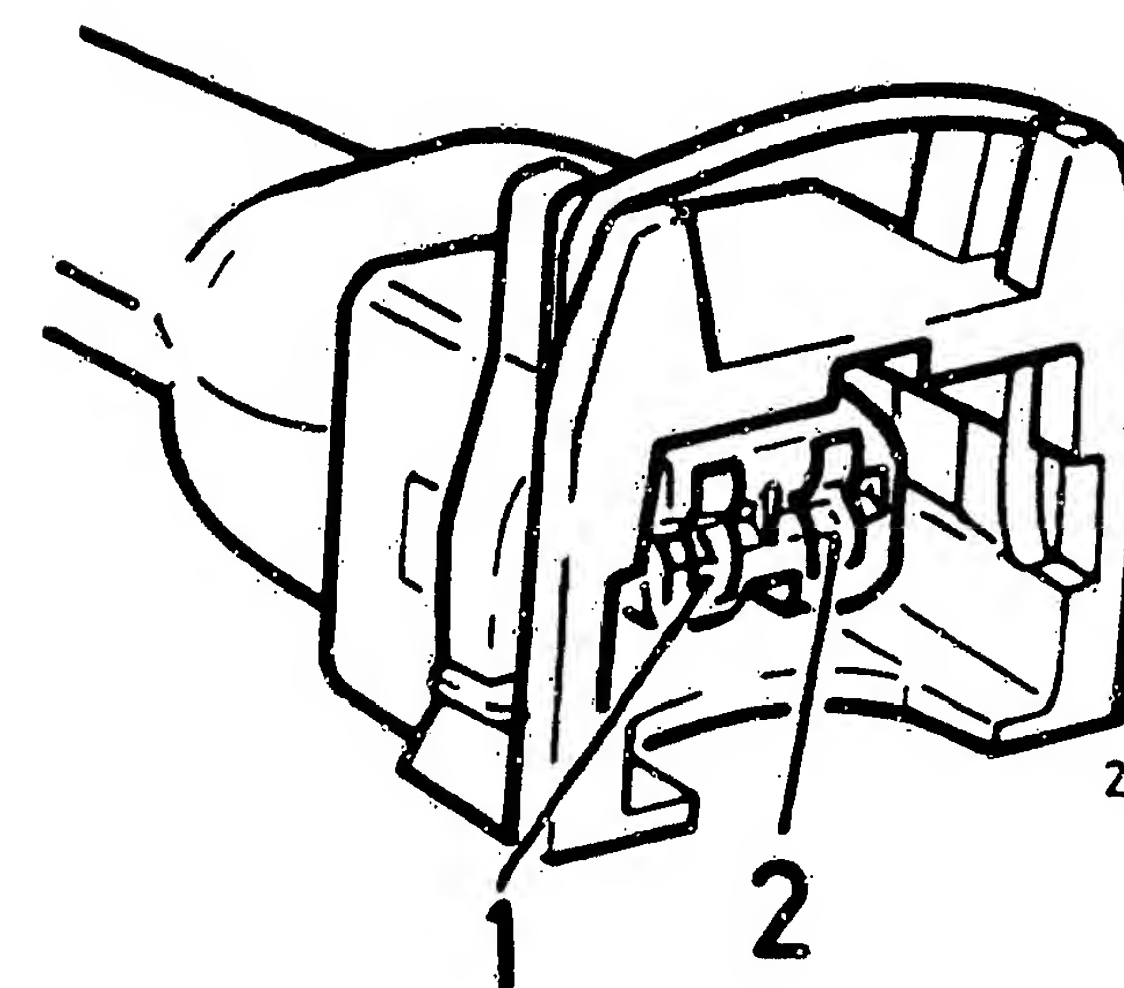
N>

Connect term. 1 of connector with test leads KDZS 0004 to positive terminal of battery.
Connect further test lead KDZS 0004 to second contact of valve.

Briefly connect test lead several times to engine ground. It must be possible to hear and feel the valve switching.

Does the valve switch?

Renew tank ventilation valve if it sticks or does not move freely.



Continued on next picture page

Test solenoid-operated injection valves.

Detach plugs at solenoid-operated injection valves.

Connect ohmmeter to solenoid-operated injection valve.
Perform test at all injection valves.

Set value: see brief instructions

Is set value attained?

N>

Renew respective solenoid-operated injection valve.

Removal:

Detach connector.

Pull out retaining clip.

Remove injection valve.

Caution!

Catch fuel as it emerges; it must not be allowed to get on to hot parts of engine.

Fitting:

Only oil O-rings slightly (engine oil HD 30).

Attach injection valve to fuel distributor.

Insert retaining clip into groove and engage it.

Test for fuel leaks.

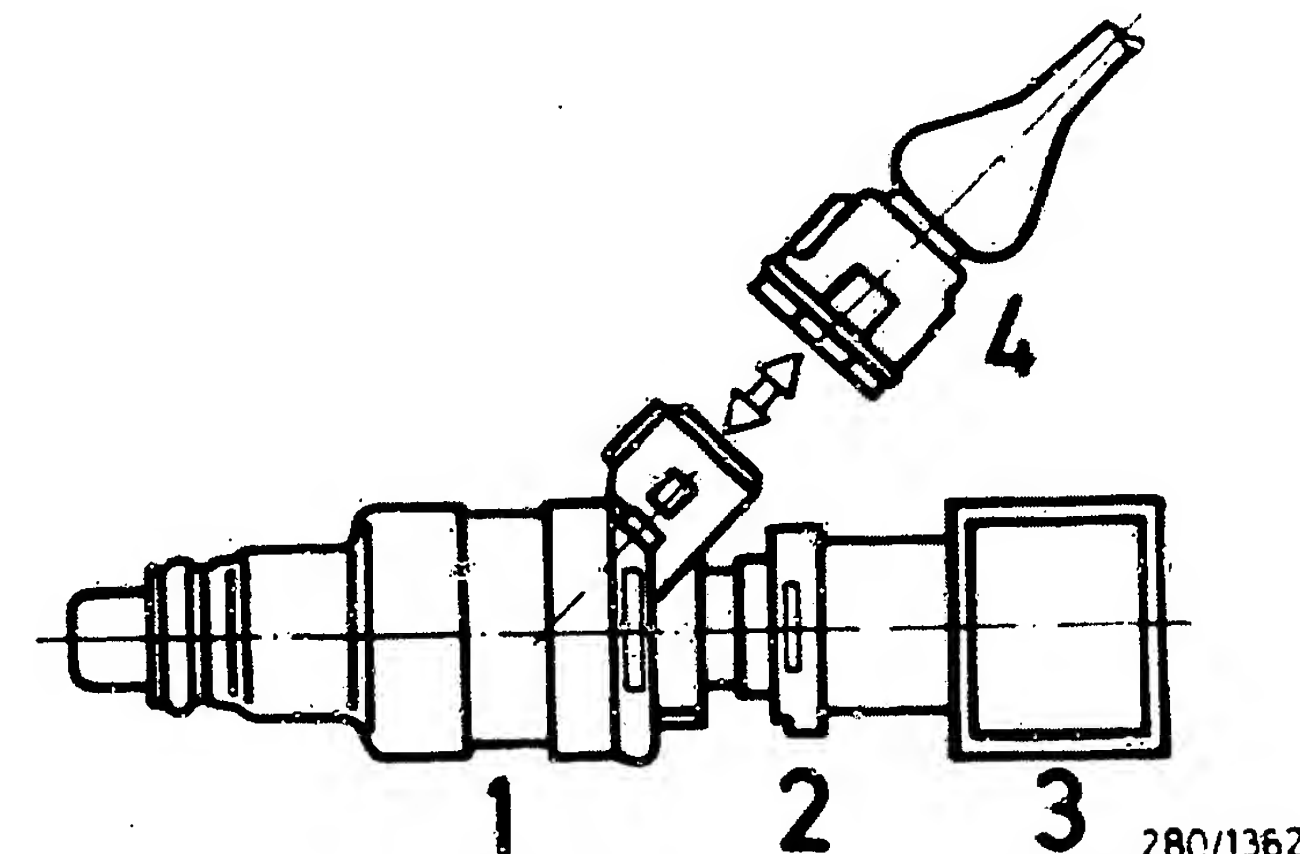
Attach connector.

Install complete fuel distributor.

In doing so, press all injection valves simultaneously into intake-manifold guide.

Caution!

Never damage O-rings or valve needle. Ensure that there are no intake-manifold leaks.



1 = Injection valve

2 = Holding clamp

3 = Fuel-distribution pipe

4 = Connector

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (14)

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

Set value: approx. 0 Ω

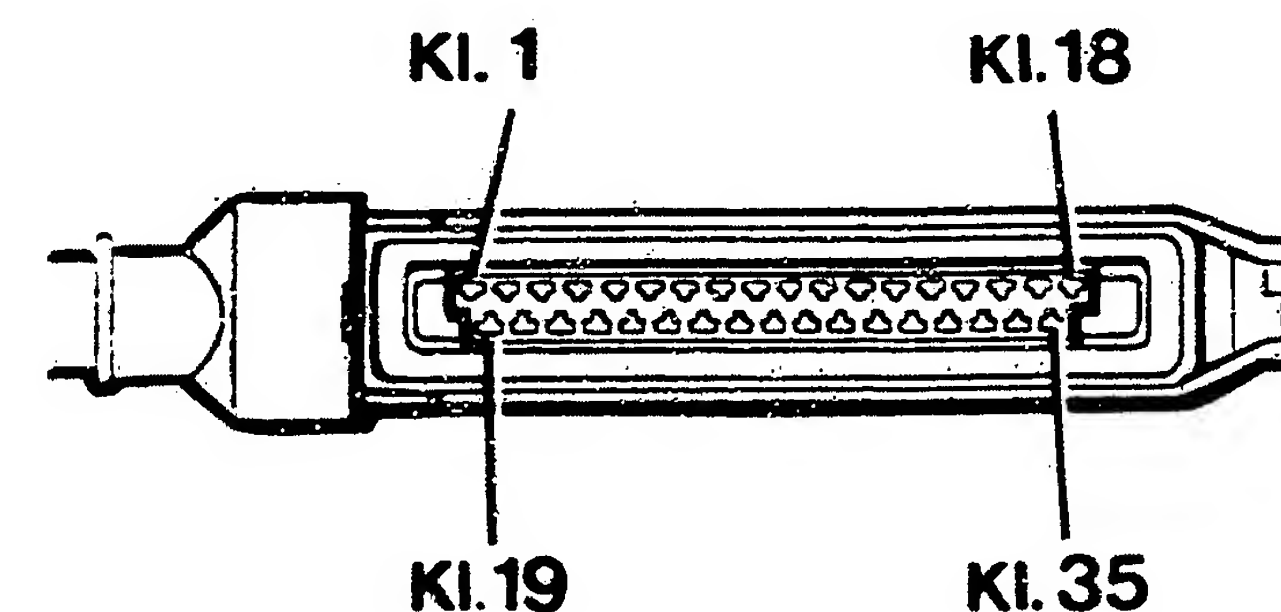
From control-unit plug term. 18 to connector of injection valve.

From pump relay term. 87 to connector of injection valve.

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/925

Detach connectors of solenoid-operated injection valves.

Switch on ignition

Measure voltage at connector term. 2 with respect to vehicle ground.

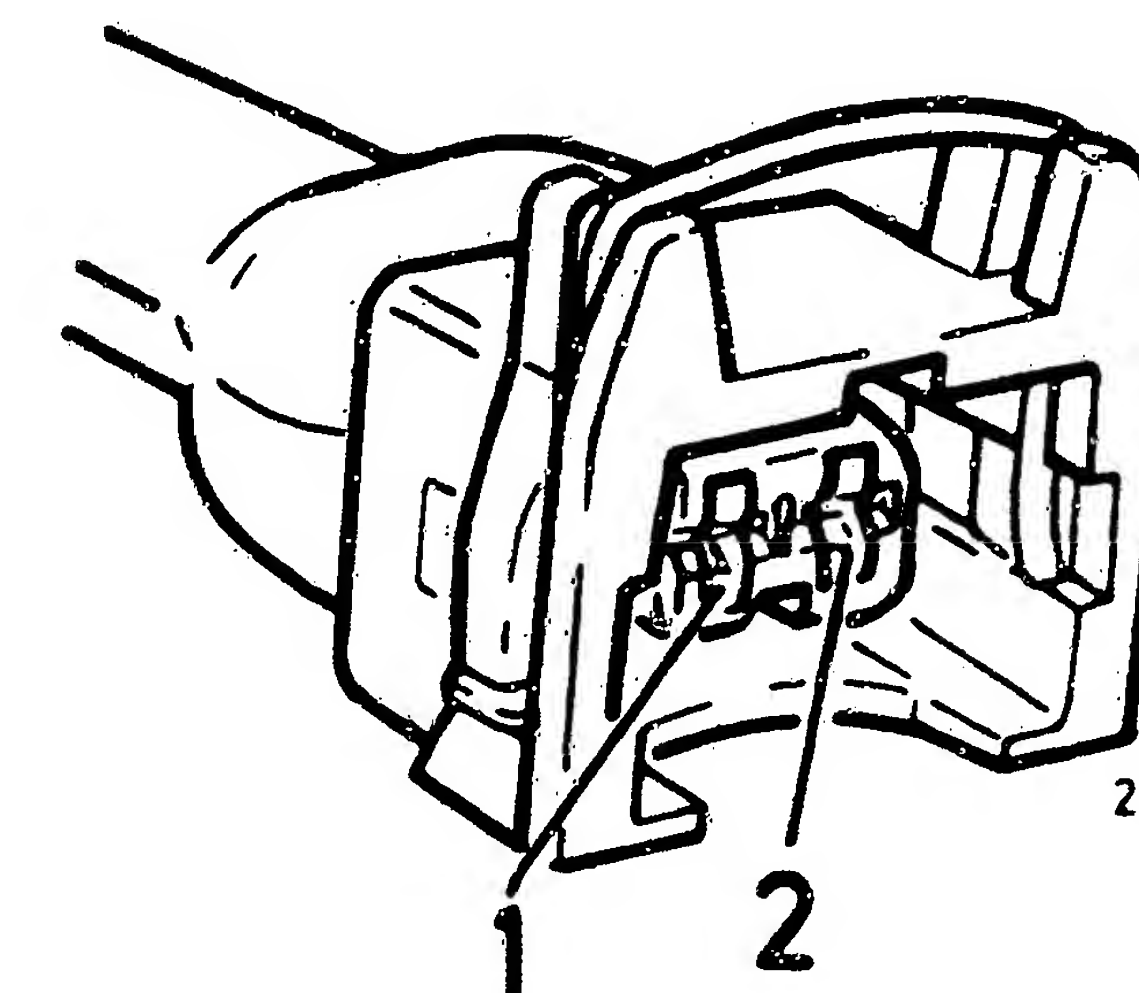
Perform test on all connectors.

Set value: 8...15 V

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/1036

Renew control unit.

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (15)

Check solenoid-operated injection valves with engine running.

N>

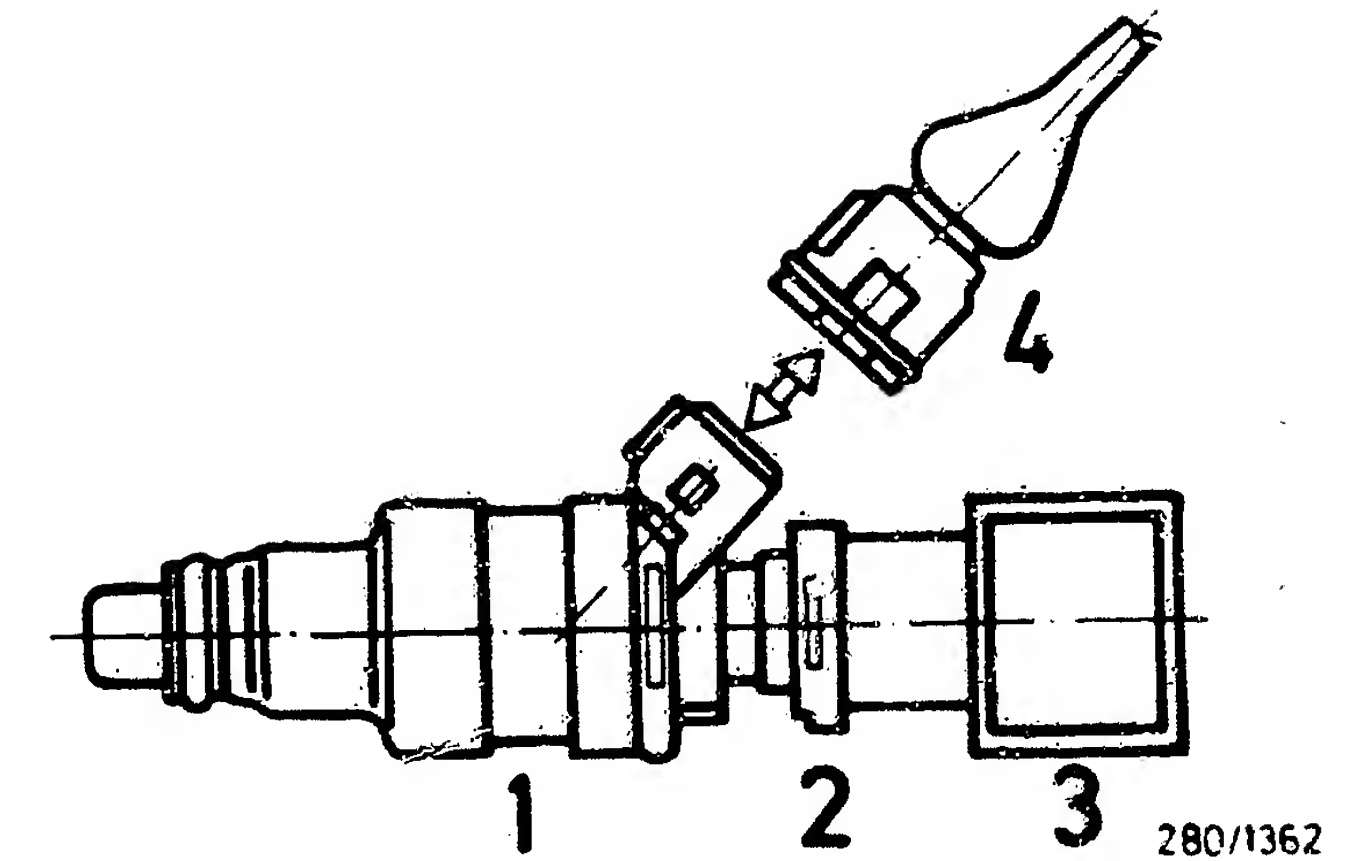
No drop in engine speed =>
Replace injection valve
in question.

With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (14)

Test hot-wire air-mass meter

Detach plug from hot-wire air-mass meter.

Connect ohmmeter to term. 2 and term. 2 at hot-wire air-mass meter.

Set value: see brief instructions

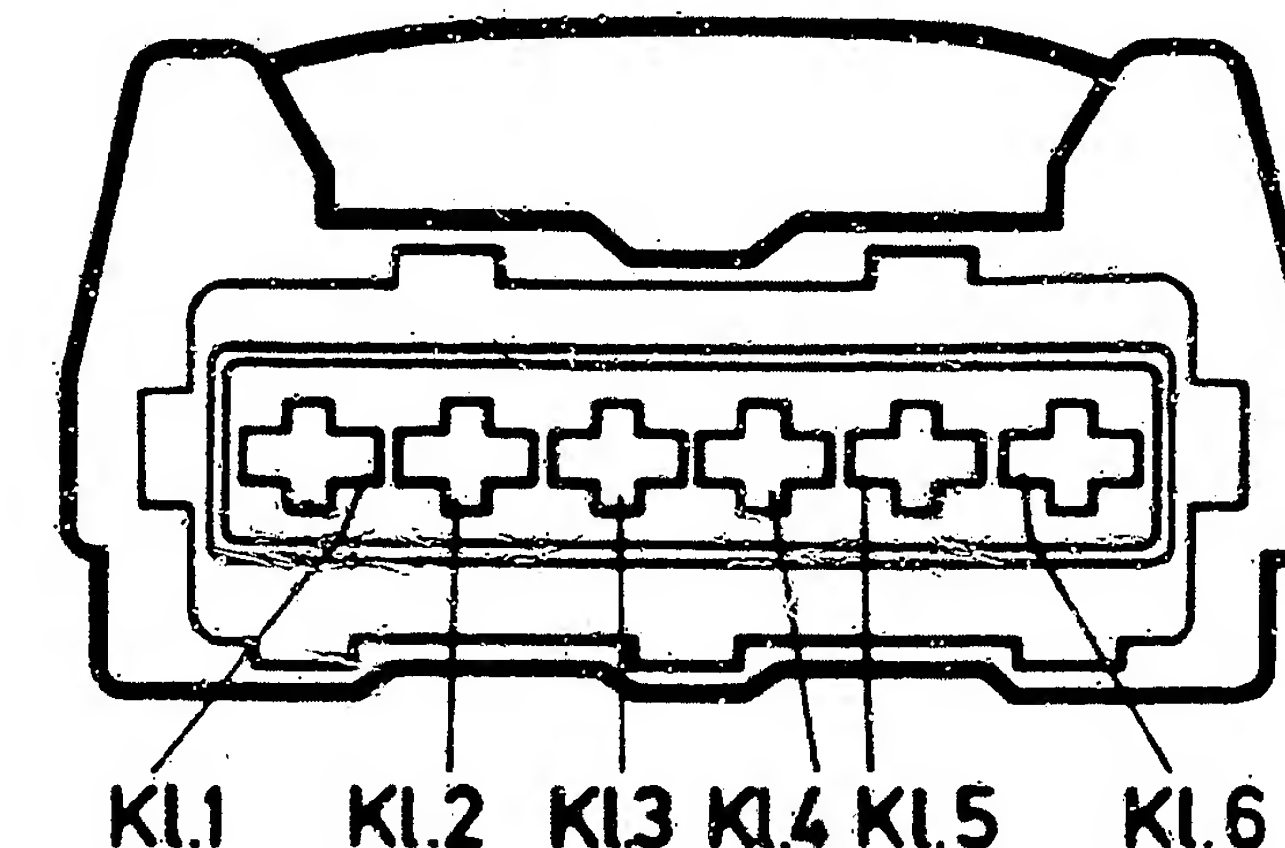
Is set value attained?

Renew hot-wire air-mass meter.

Perform visual inspection of plug for hot-wire air-mass meter:
Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Eliminate defects on plug.
If necessary, replace plug or spring contacts.



280/1505

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (17)

V

Use ohmmeter to test leads from hot-wire air-mass meter to control unit for continuity.

Set value: approx. 0 Ω

Air-mass meter to Control-unit plug

Term.2 Term.6

Term.3 Term.7

Term.4 Term.8

Lead from hot-wire air-mass meter term.5 to main relay term.87.

Set value: approx. 0 Ω

Lead from hot-wire air-mass meter term.1 to vehicle ground.

Set value: approx. 0 Ω

Watch out for worn cable insulation and loose contacts.

Are set values obtained?

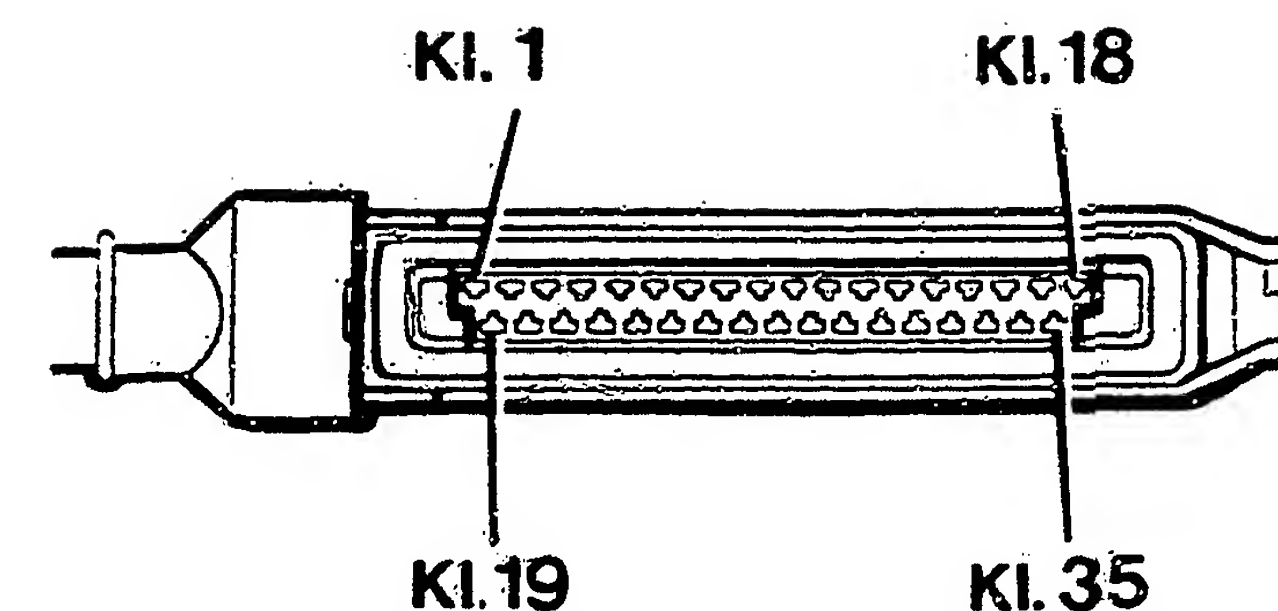
N>

Eliminate contact resistances, open circuits and short circuits in leads.

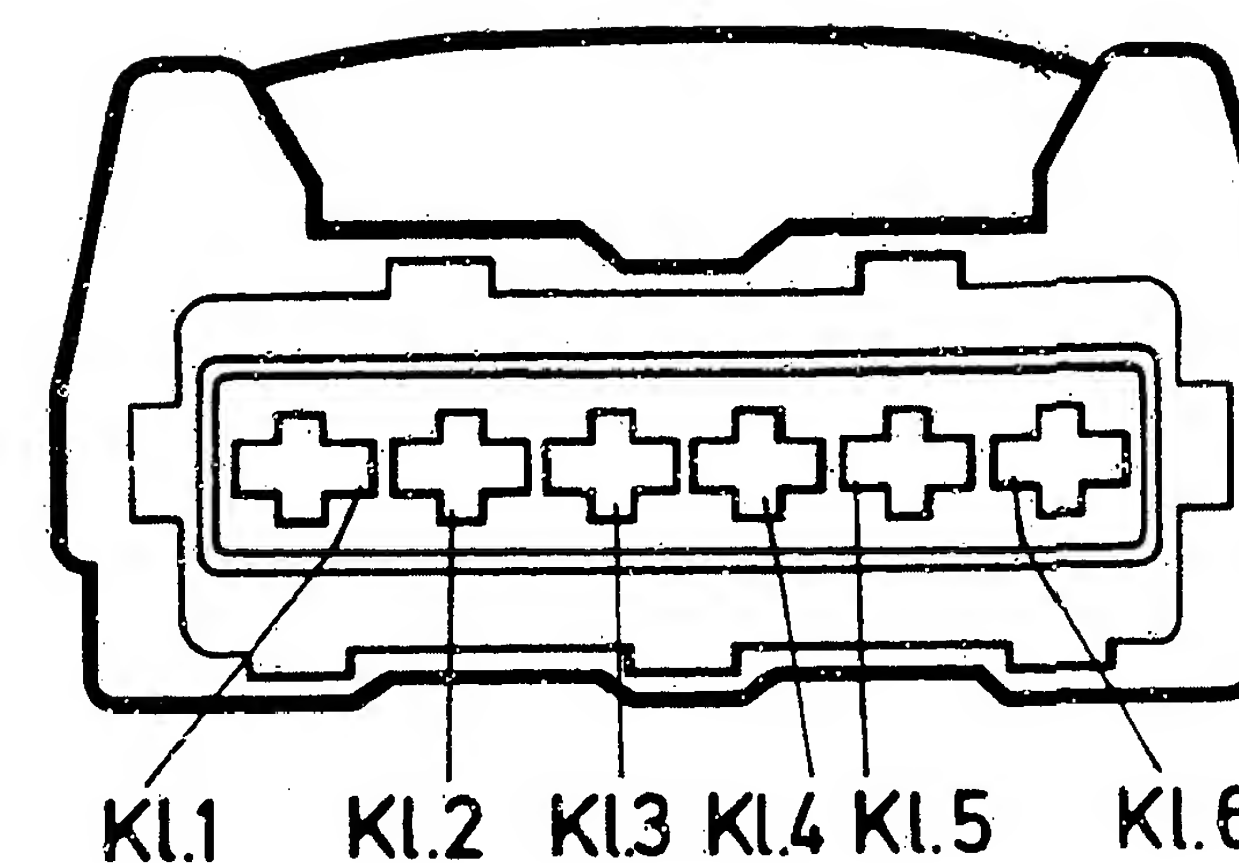
Y

V

Continued on next picture page



227/925



280/1505

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED (18)

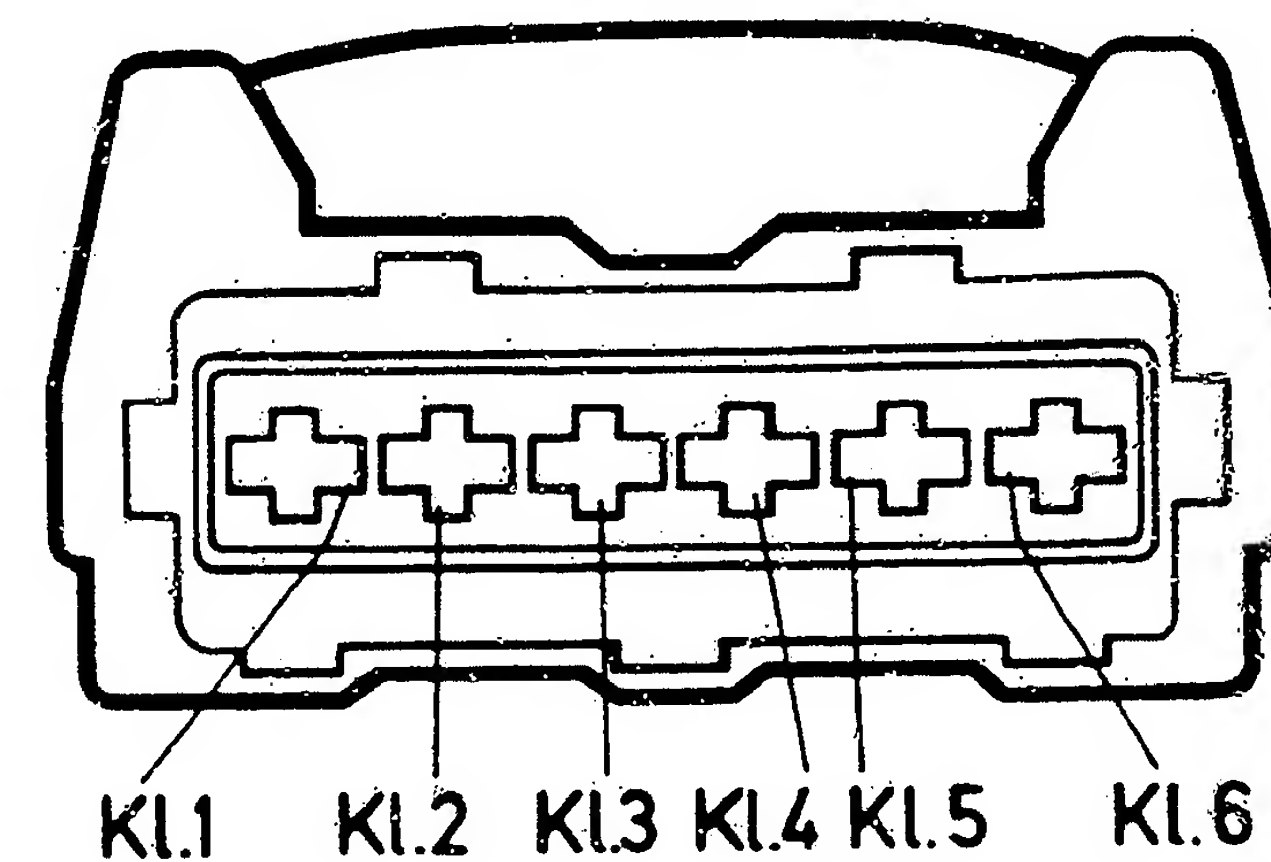
Push back rubber sleeve of hot-wire
air-mass meter.
Connect voltmeter with test prods
to term.5 (+) and term.1 (-)
(see top picture).
Switch on ignition.
Set value: 8...15 V

Measure voltage at term.3 (+)
and term.2 (-).
Start engine. Voltage is a function
of load.
Set value: 2...5 V

Are set values obtained?

Visually inspect leads for contact
(worn insulation).

Control unit defective, renew.



280/1505

Return to self-diagnosis
test table B15

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (11)

SELF-DIAGNOSIS FLASHING CODE 223

No idle-speed regulation function.

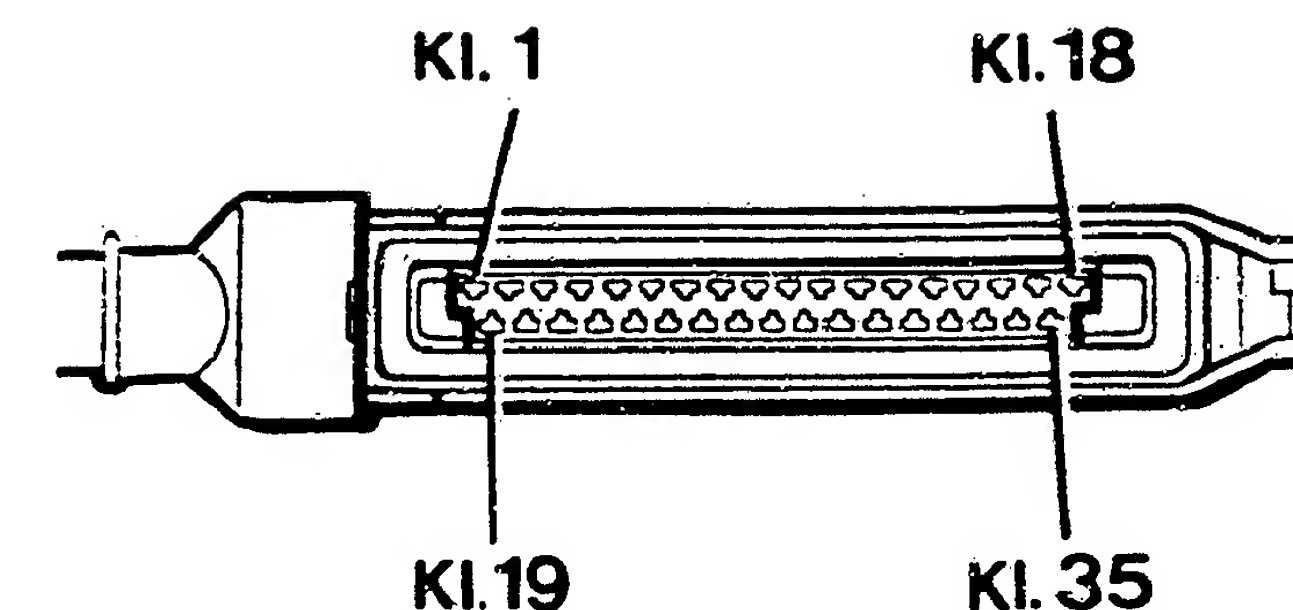
Detach connector at idle actuator.

Connect ohmmeter directly to idle actuator.

Set value: see brief instructions

Is set value attained?

Replace idle actuator.



227/925

Detach connector at idle actuator.

Switch on ignition.

Connect voltmeter with test prod to connector term. 1 (+) and vehicle ground.

Set value: 8...15 V

Is set value attained?

Use ohmmeter to test following leads for continuity.

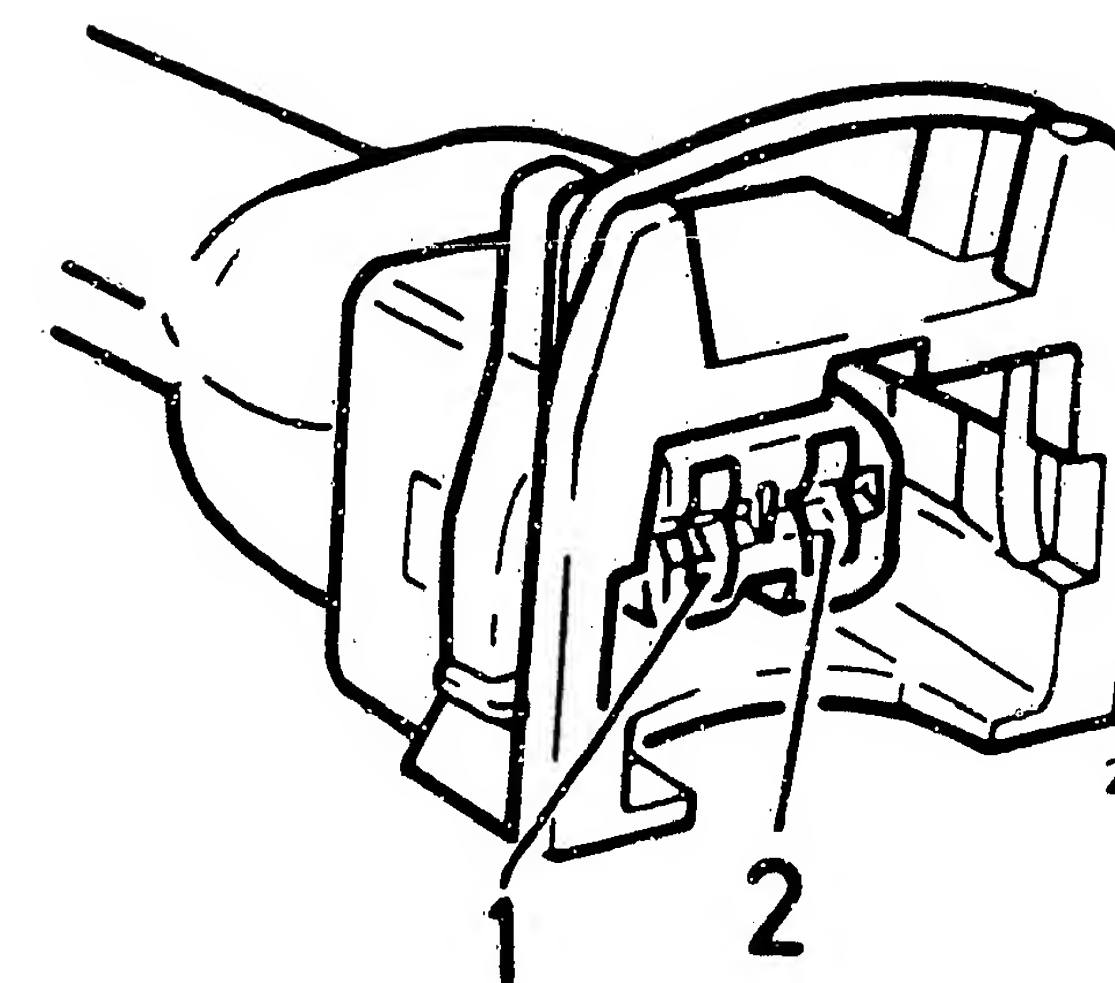
Set value: approx. 0 Ω

From connector term. 1 to pump relay term. 87.

From control-unit plug term. 33 to connector term. 2.

Eliminate contact resistances, open-circuits and short-circuits at leads.

Test plug for corrosion and loose contact. It must not be possible to push back contacts.



227/1036

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (11) CONTINUED (1)

Test actuation of idle actuator.

Start engine.
Idle actuator is clocked by control unit and vibrates (can be felt with hand).

Idle actuator vibrates?

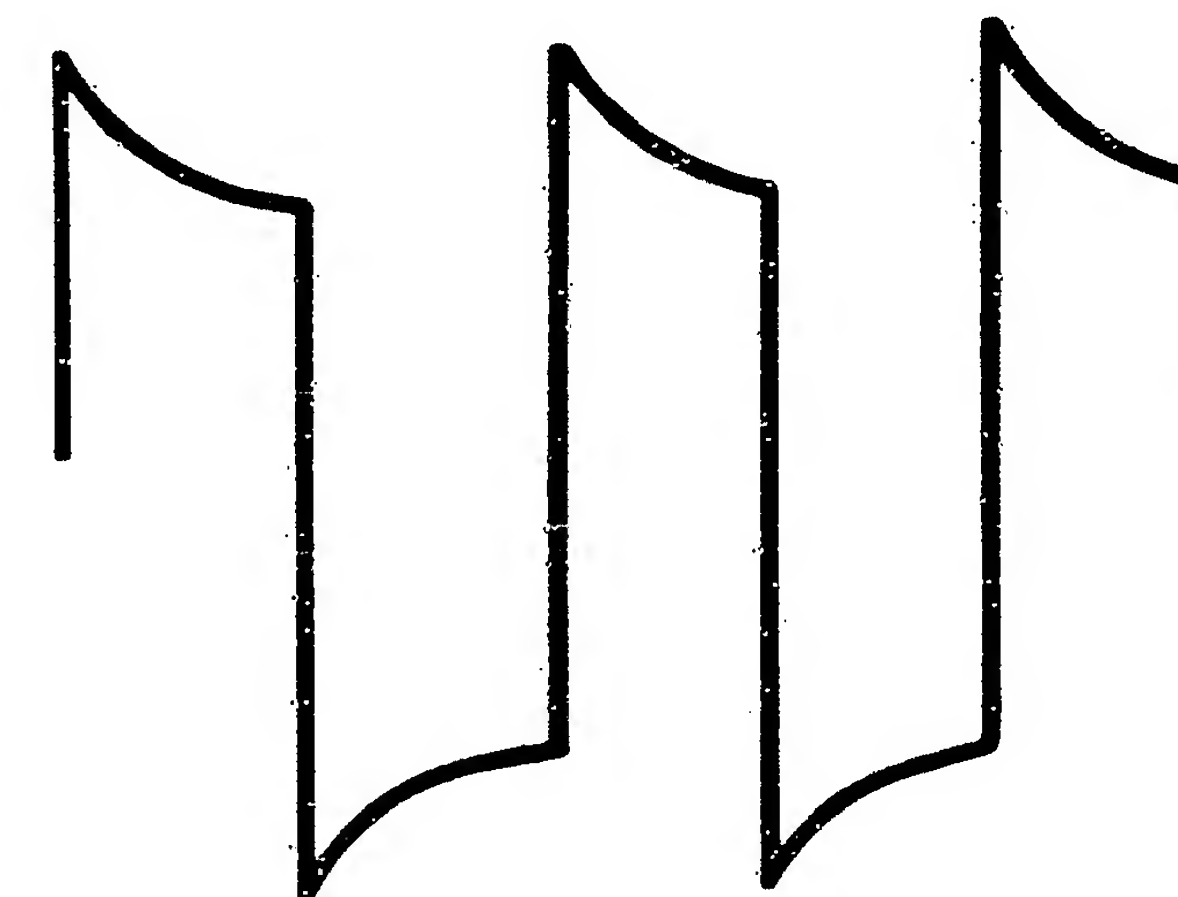
N>

Measure signal at idle actuator:

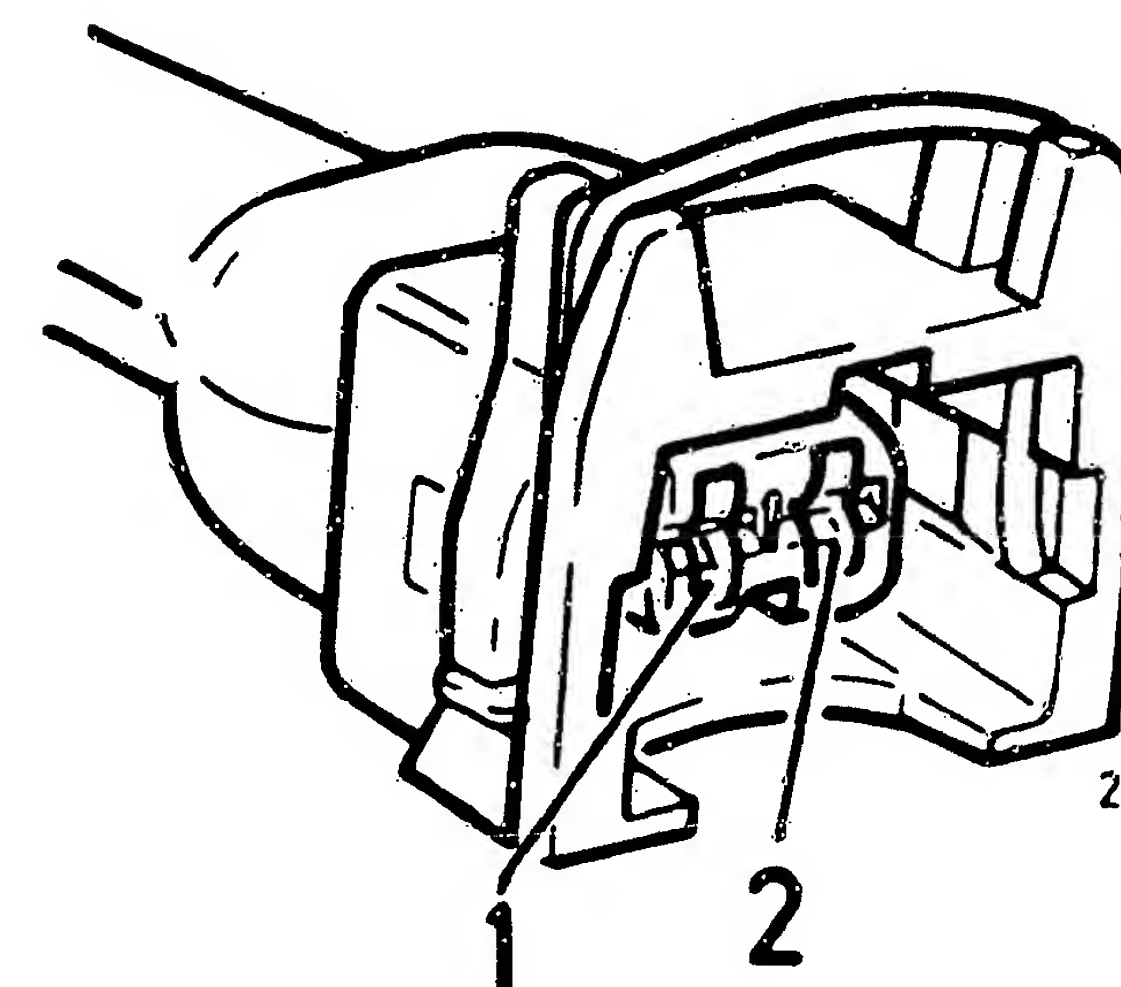
*Push back rubber sleeve at 2-pole plug for idle actuator.
Connect Motortester (special input) with test prods:
Red clip to term. 1 of connector.
Black clip to term. 2 of connector

Start engine.
If connection is correct, signals appear on the oscilloscope (top picture).

If no signals appear:
*Check leads to control unit for continuity.
*Replace control unit.



261/0259



227/1036

Return to self-diagnosis
test table B17

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12)

SELF-DIAGNOSIS FLASHING CODE 231

Adaption limits of lambda closed-loop control (multi).

Possible sources of fault:

- * No or incorrect functioning of lambda closed-loop control.
- * Hot-wire air-mass meter defective
- * Tank ventilation valve always open

Indicated items O.K.?

Test lambda closed-loop control function of control unit:

Connect CO analyzer to sampling ahead of catalytic converter. Disconnect negative terminal of battery and reconnect after 1 minute (operation serves to clear adaption values from control unit).

Disconnect connector of lambda sensor (arrow, lower picture). Start engine and allow it to idle.

Measure CO content. Set value: see brief instructions

Is set value attained?

N>

CO CONTENT TOO HIGH

Use ohmmeter to test following lead for short-circuit to ground. Set value: infinity Ω

From control-unit plug term. 24 to control-unit plug term. 5.

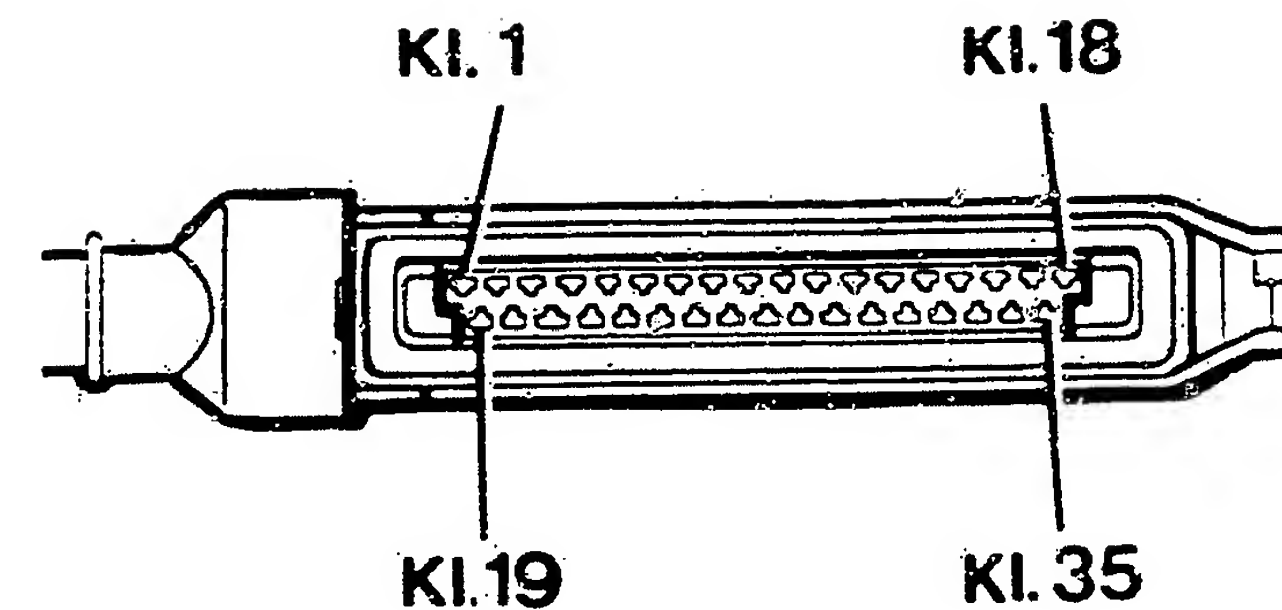
If set value is attained, renew control unit.

CO CONTENT TOO LOW

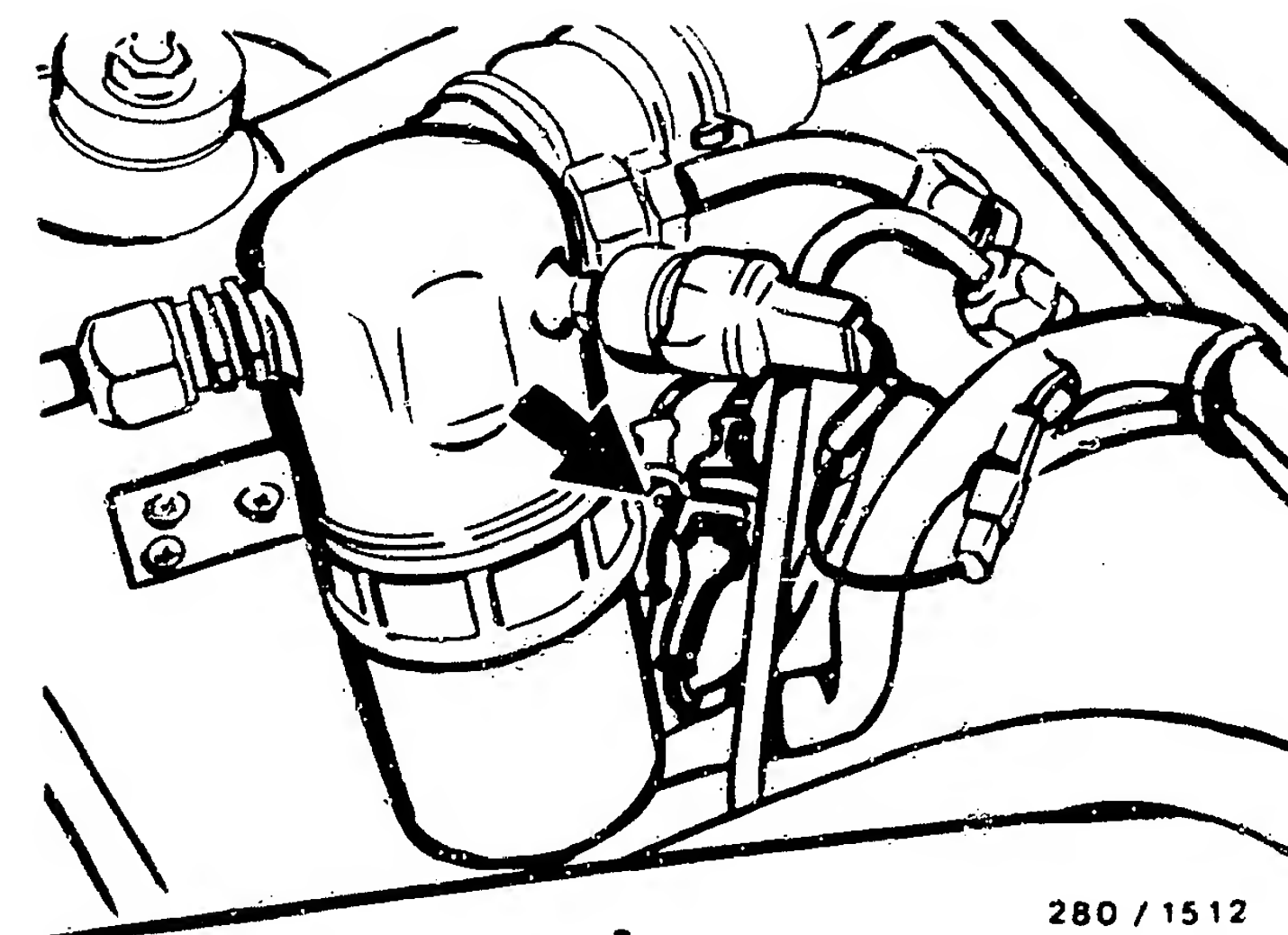
Use ohmmeter to test following lead for short-circuit to U Bat .

From control-unit plug term. 24 to control-unit plug term. 4.

If set value is attained, renew control unit.



227/925



280 / 1512

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (1)

Test closed-loop control function of control unit.

Run engine at idle speed.

Hold lambda-sensor lead to control unit against vehicle ground.

Set value: CO content increases.

Hold lambda-sensor lead to control unit against positive terminal of 1.5 V battery and negative terminal of battery against vehicle ground.

Set value: CO value decreases.

Are set values attained?

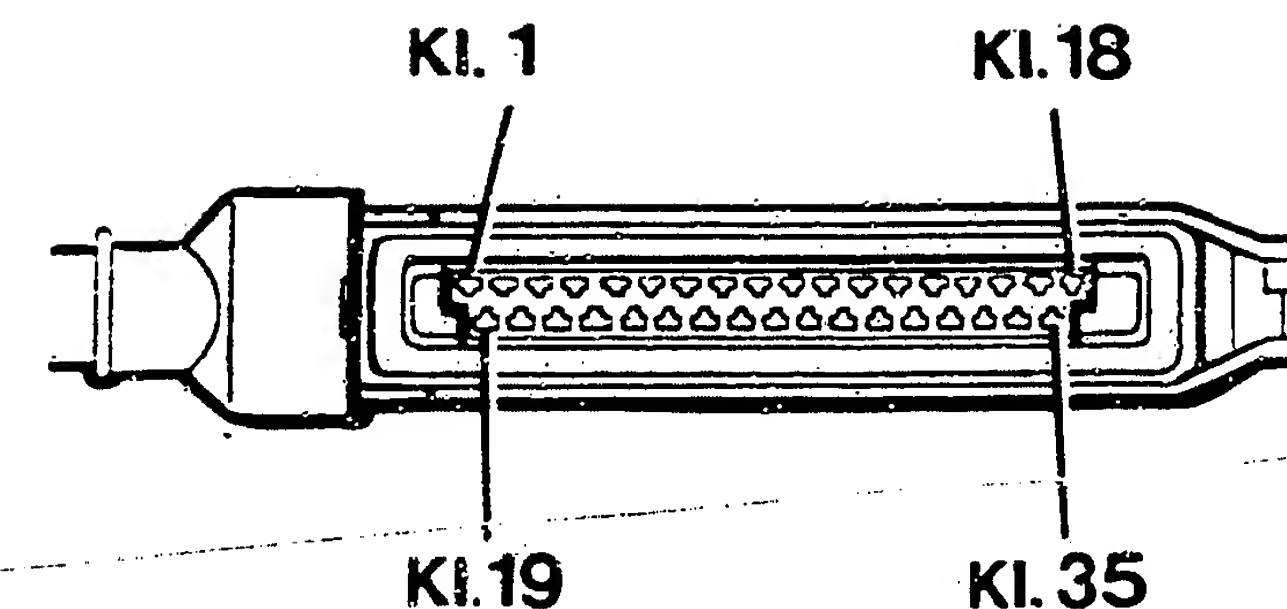
N>

Use ohmmeter to test following lead for continuity.

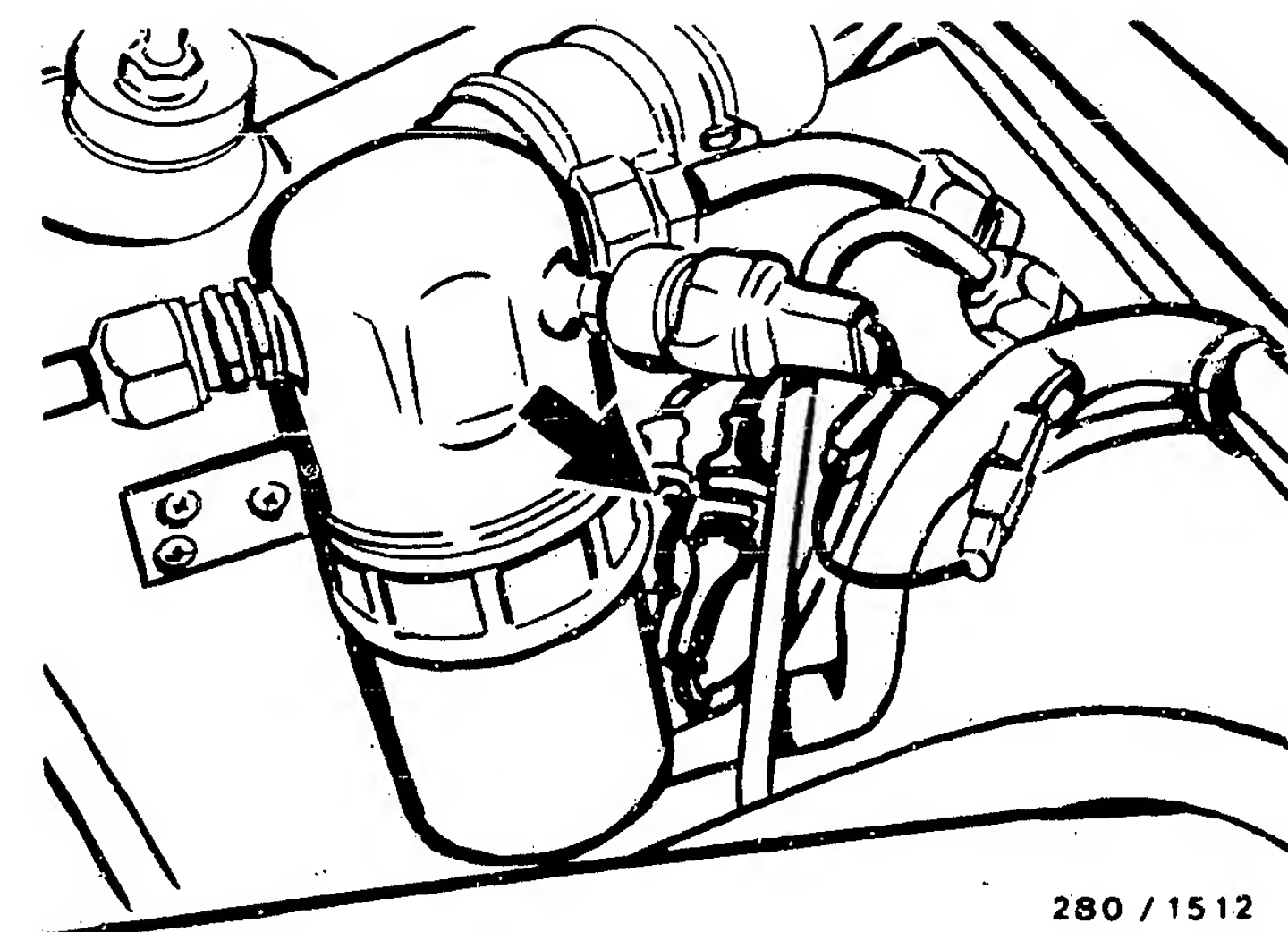
Set value: approx. 0 Ω

From control-unit plug term. 24 to plug connection of lambda sensor.

If lead is O.K., renew control unit.



227/925



280 / 1512

Continued on next picture page

E11

<=>

E12

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (2)

Test hot-wire air-mass meter

Detach plug from hot-wire air-mass meter.

Connect ohmmeter to term. 3 and term. 2 at hot-wire air-mass meter.

Set value: see brief instructions

Is set value attained?

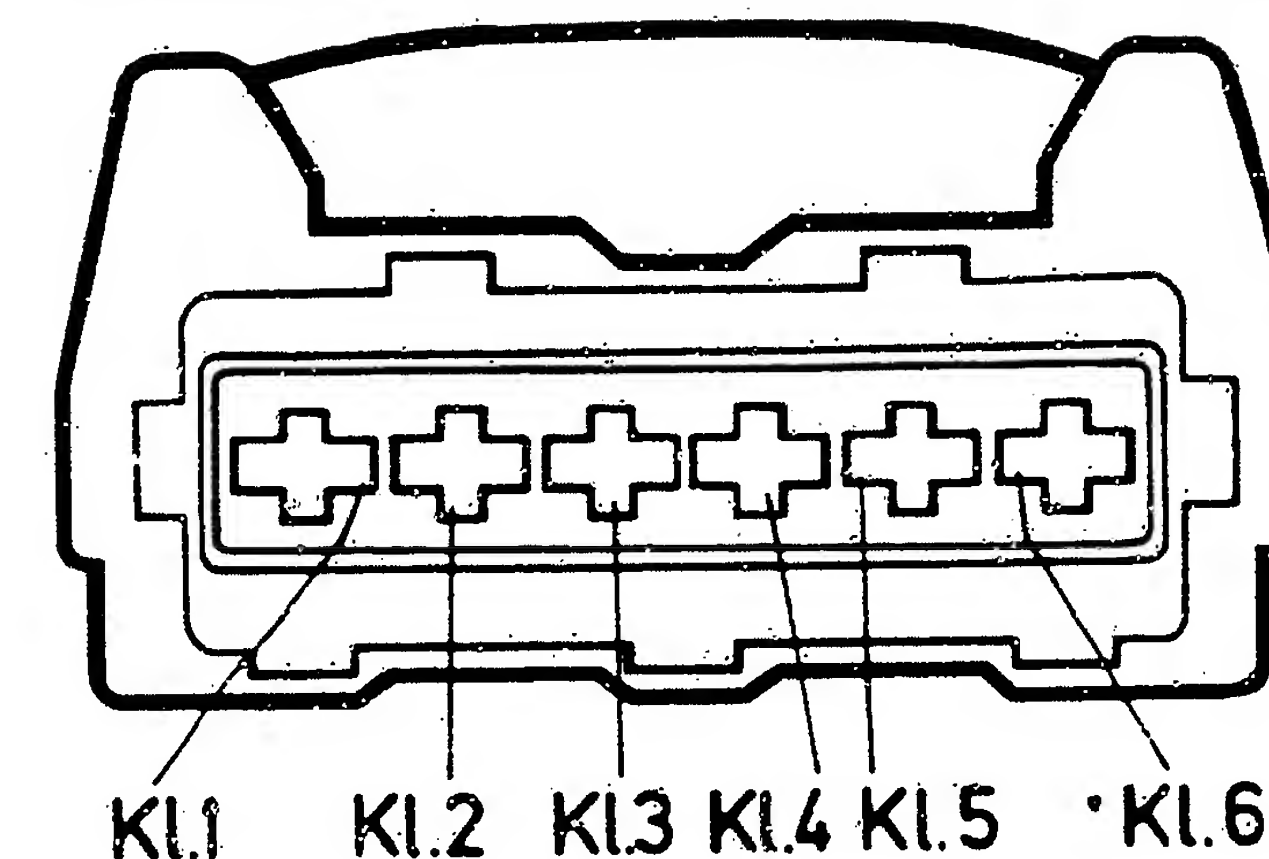
Renew hot-wire air-mass meter.

Perform visual inspection of plug for hot-wire air-mass meter:

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Eliminate defects on plug.
If necessary, replace plug or spring contacts.



280/1505

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (3)

V

Use ohmmeter to test leads from hot-wire air-mass meter to control unit for continuity.

Set value: approx. 0 Ω

Air-mass meter to Control-unit plug

Term.2 Term.6

Term.3 Term.7

Term.4 Term.8

Lead from hot-wire air-mass meter term.5 to main relay term.87.

Set value: approx. 0 Ω

Lead from hot-wire air-mass meter term.1 to vehicle ground.

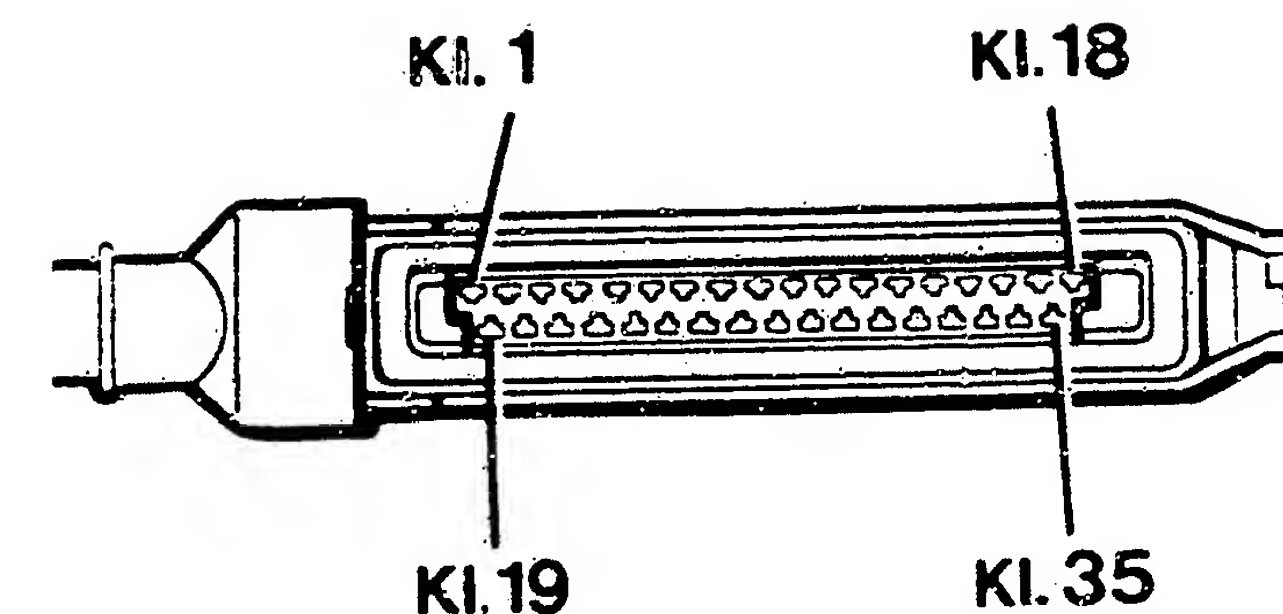
Set value: approx. 0 Ω

Watch out for worn cable insulation and loose contacts.

Are set values obtained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.

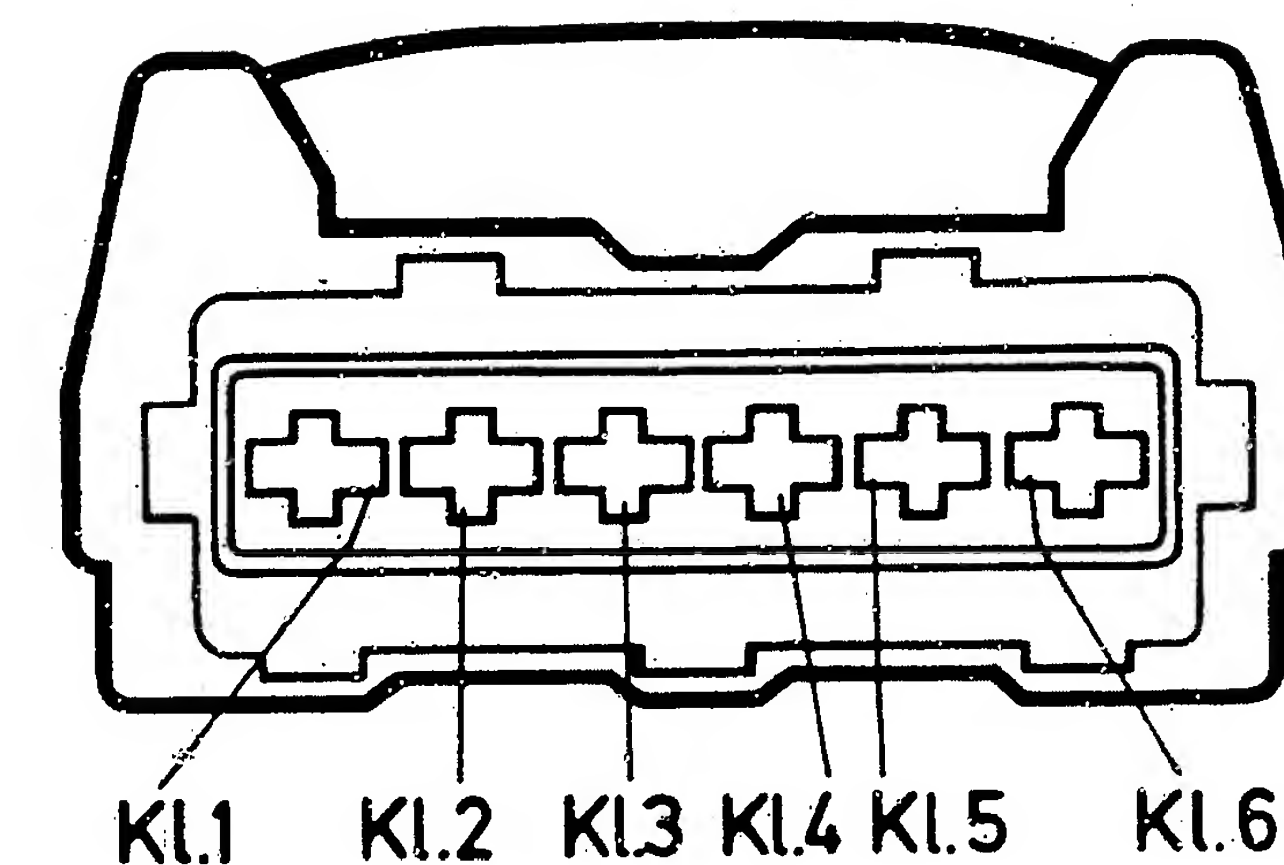


227/925

Y

V

Continued on next picture page



280/1505

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (4)

Push back rubber sleeve of hot-wire
air-mass meter.
Connect voltmeter with test prods
to term.5 (+) and term.1 (-)
(see top picture).
Switch on ignition.
Set value: 8...15 V

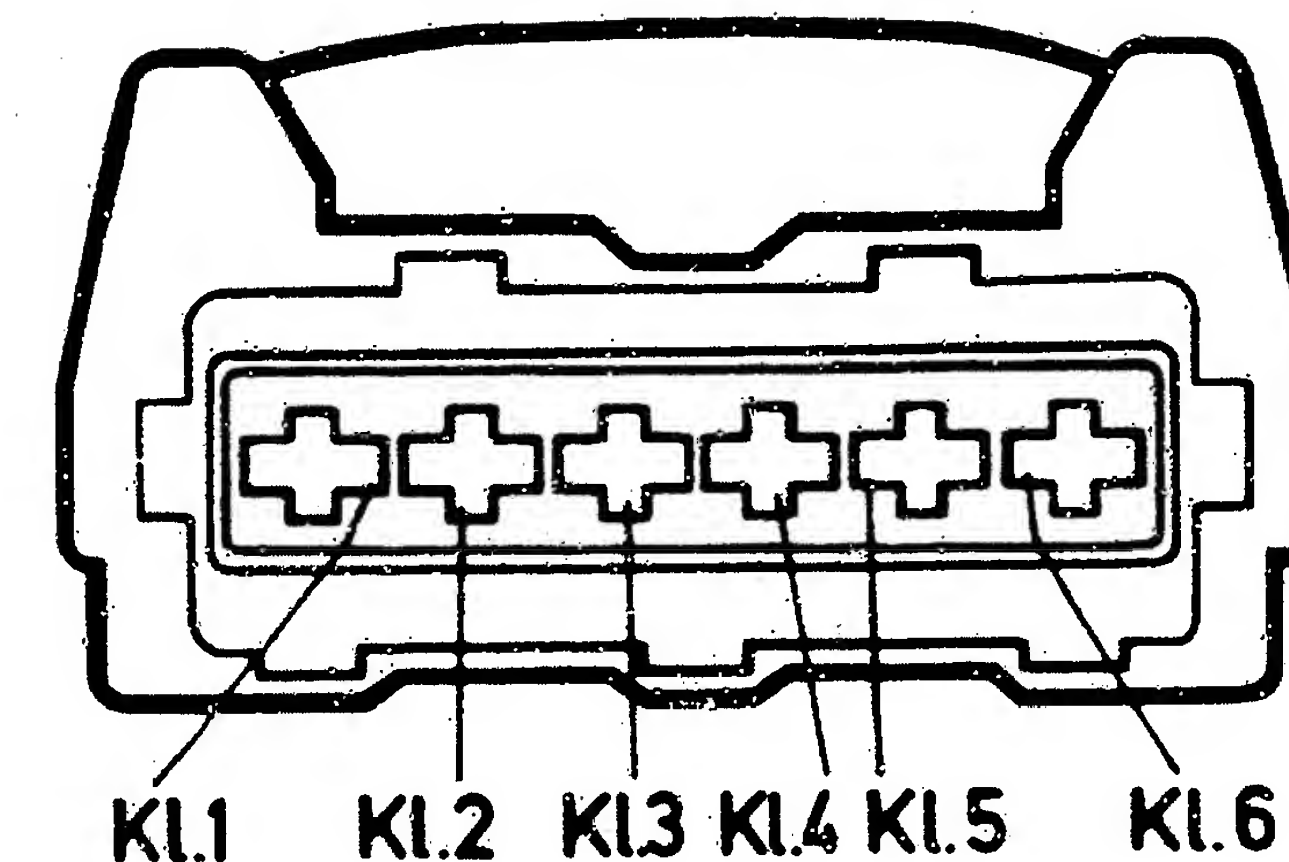
Measure voltage at term.3 (+)
and term.2 (-).
Start engine. Voltage is a function
of load.
Set value: 2...5 V

Are set values obtained?

N>

Visually inspect leads for contact
(worn insulation).

Control unit defective, renew.



280/1505

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (5)

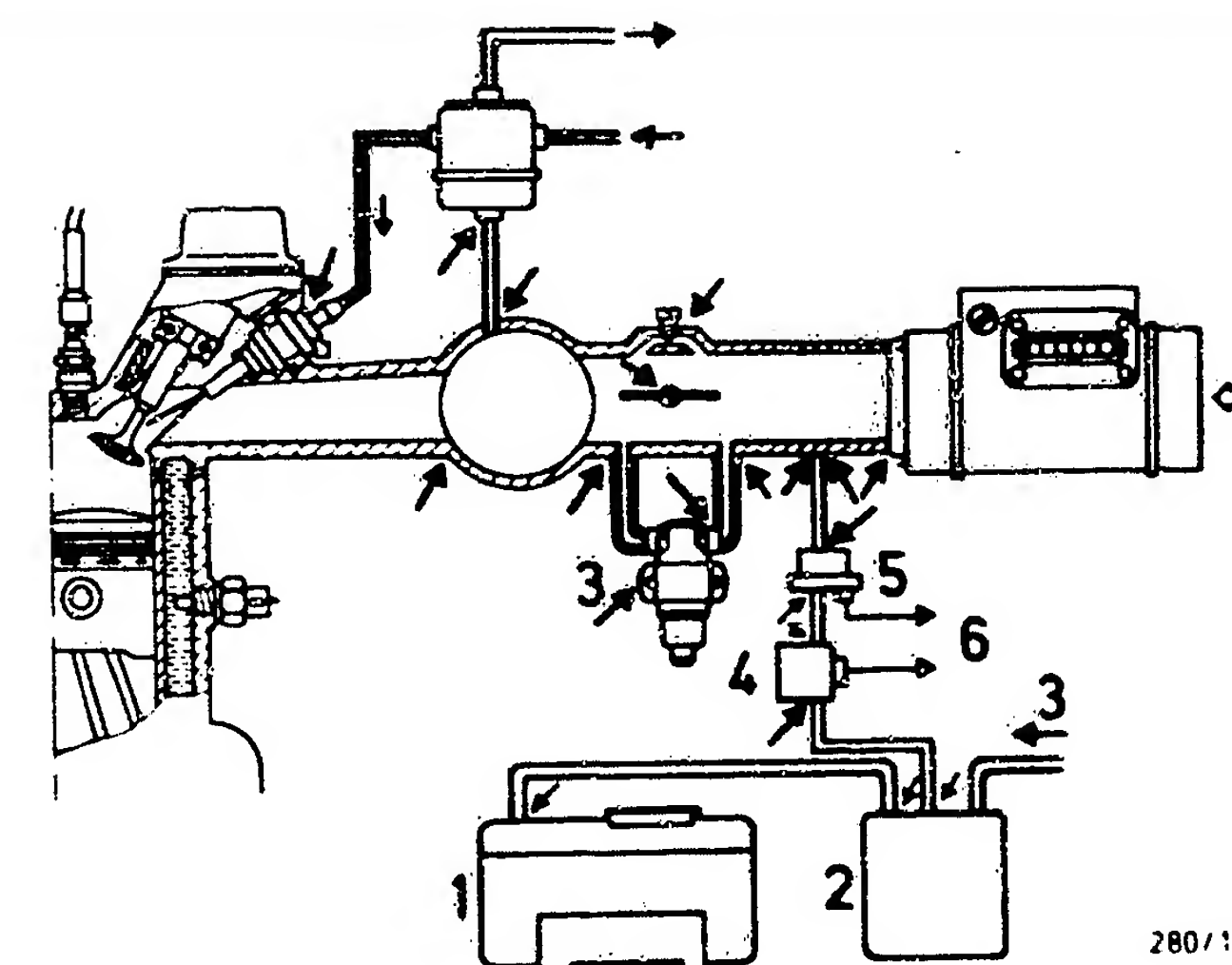
Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

N>

Replace defective hoses as necessary.
Eliminate leakages by tightening hose clamps.



280/1508

- 1 = Fuel tank
- 2 = Activated-carbon canister
- 3 = Air supply
- 4 = Solenoid-operated valve
- 5 = Tank-ventilation valve
- 6 = Electrical connections

Arrows = possible leakage points

Continued on next picture page

V
Functional test of tank ventilation valve

Test actuation signal for ACF frequency valve with oscilloscope. To do so, connect 2-pole test lead 1 684 463 093 between tank ventilation valve and its connector.

Connect Motortester (special input) to test lead:
Red pickup to one of the test-lead connections, black pickup to engine ground.

Caution: the free test-lead terminal must not come into contact with ground.

Start engine at operating temperature, part-load operation.

If connection is correct, oscilloscope must indicate pulses corresponding to the adjacent picture (top).

Set value: pulses

Pulses?

N>

Switch off engine and detach control-unit plug as well as tank-ventilation-valve plug.

* Use ohmmeter to test lead from control unit term. 27 to plug of tank ventilation valve term. 1 for continuity.
Set value: 0 Ω

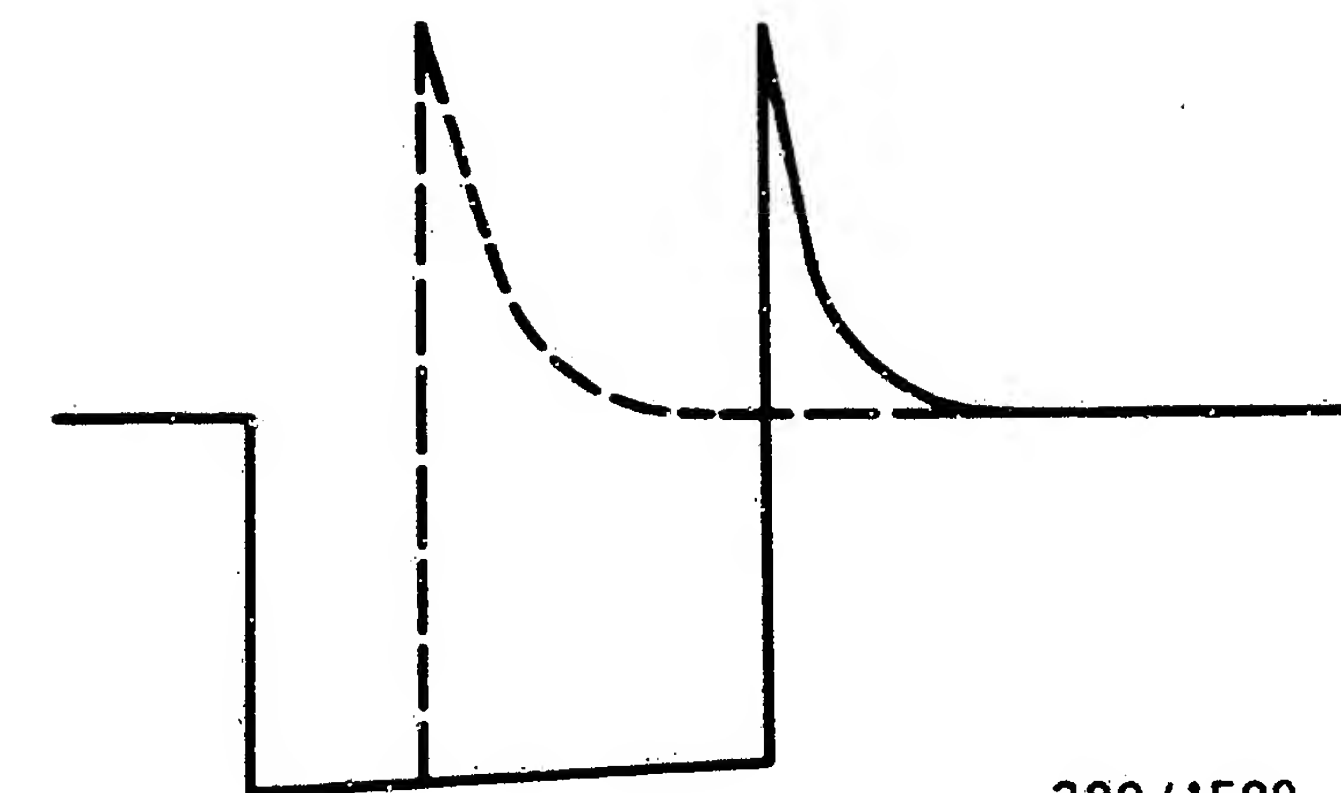
Eliminate any open-circuit.

* Switch on ignition and use voltmeter to test voltage supply at plug of tank ventilation valve term. 2.

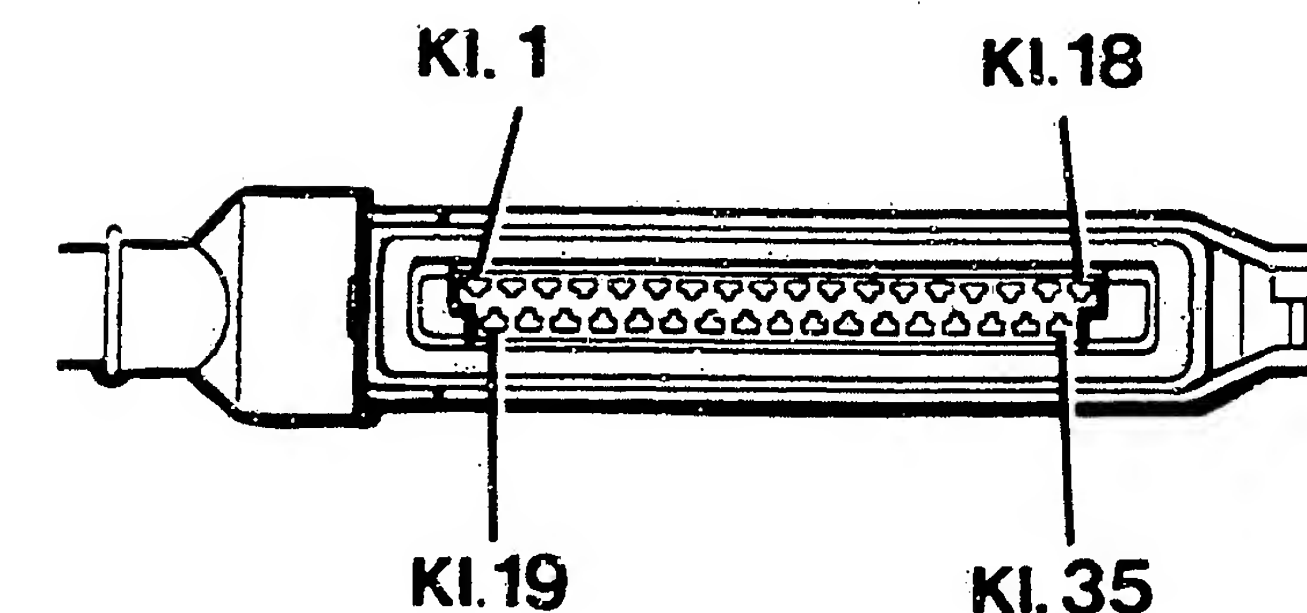
Set value: battery voltage.

Eliminate any interruption in voltage supply from ignition lock via main relay to tank ventilation valve.

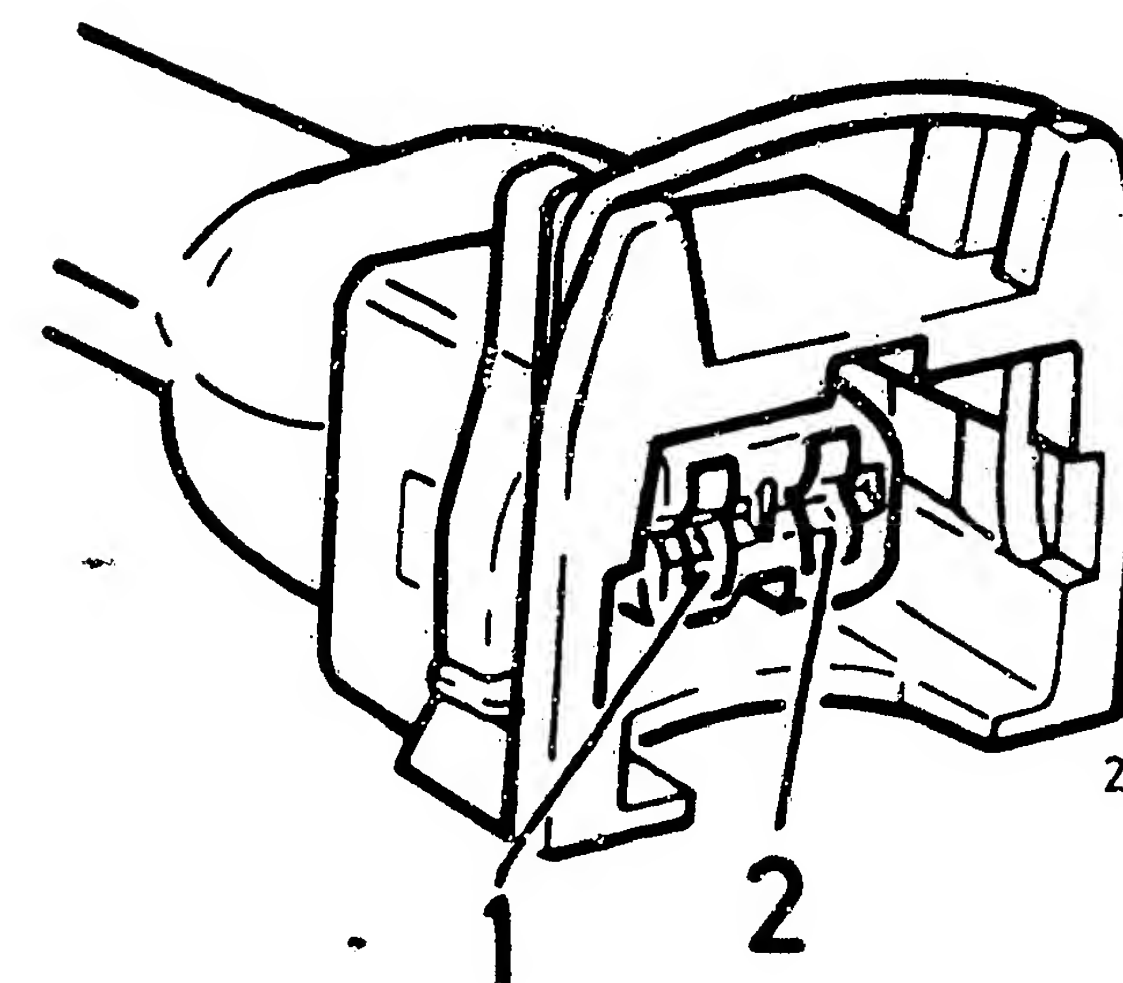
If there is no fault in lead: control unit defective.
Renew control unit.



280/1509



227/925



227/1036

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (7)

Switch off engine and detach connector at tank ventilation valve.

Use ohmmeter to measure internal resistance of valve directly at the two contacts.

Set value: see brief instructions

Is set value attained?

N>

Internal resistance not within tolerance: renew tank ventilation valve.

Y

Testing mechanical switching function of tank ventilation valve:

Connect term. 1 of connector with test leads KDZS 0004 to positive terminal of battery.
Connect further test lead KDZS 0004 to second contact of valve.

Briefly connect test lead several times to engine ground. It must be possible to hear and feel the valve switching.

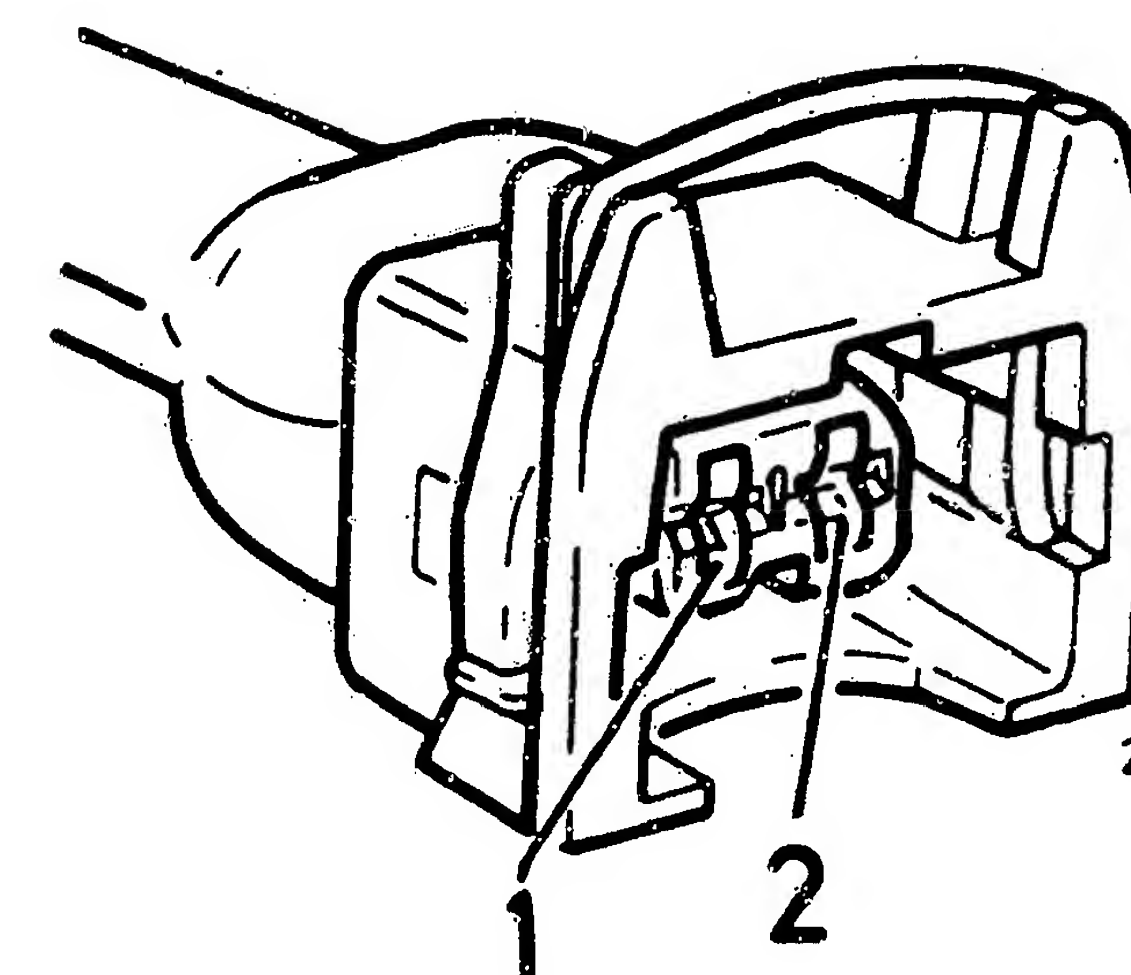
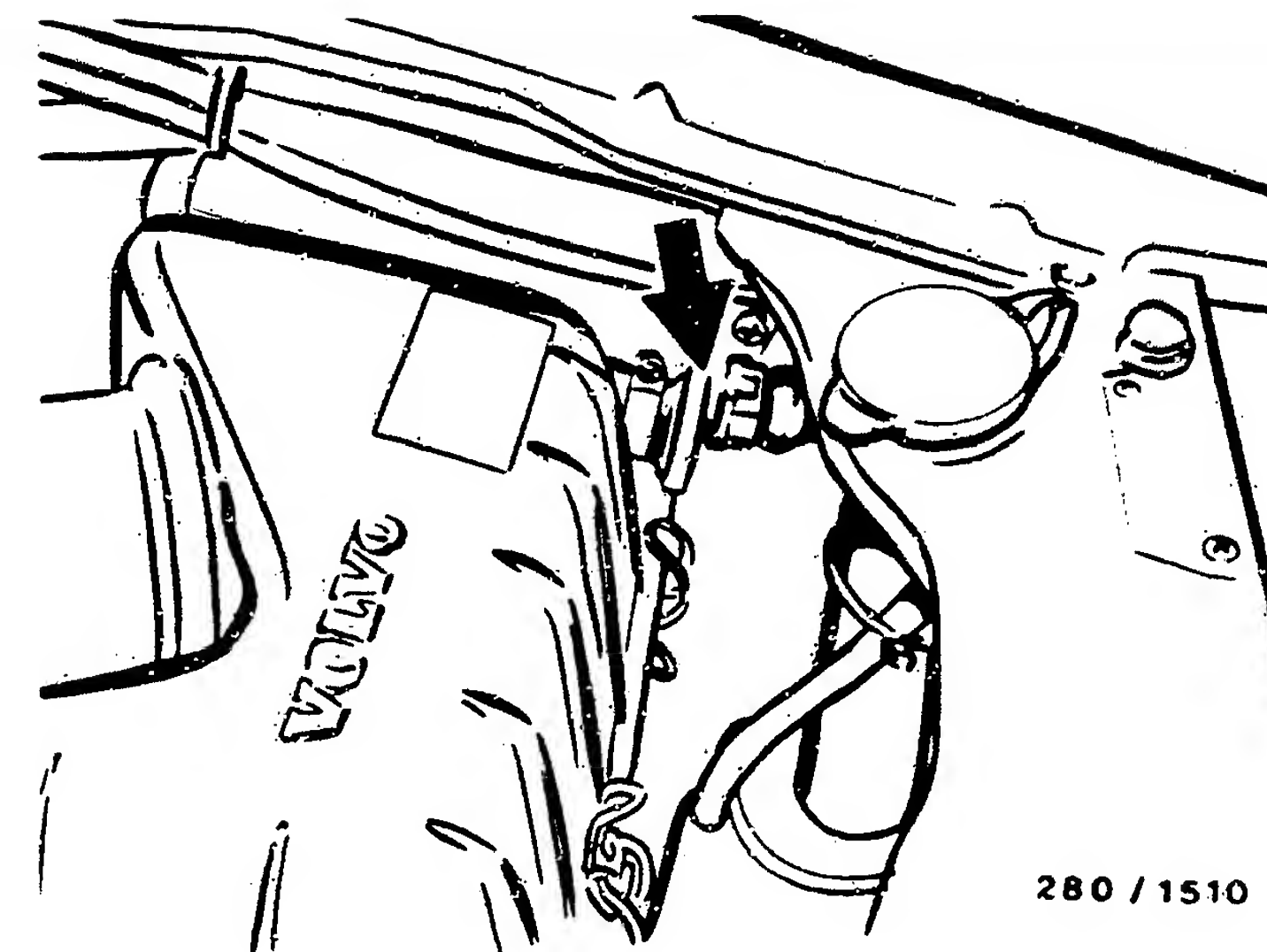
Does the valve switch?

N>

Renew tank ventilation valve if it sticks or does not move freely.

Y

Return to self-diagnosis test table B17



V

SELF-DIAGNOSIS FLASHING CODE 232

Adaption limits of lambda closed-loop control (additive).

Possible sources of fault:

- * No or incorrect functioning of lambda closed-loop control.
- * Fuel pressure/delivery of electric fuel pump
- * Leak in air intake system or exhaust system
- * Defective injection valves

Indicated items O.K.?

V

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (1)

Test lambda closed-loop control function of control unit:

Connect CO analyzer to sampling ahead of catalytic converter.
Disconnect negative terminal of battery and reconnect after 1 minute (operation serves to clear adaption values from control unit).

Disconnect connector of lambda sensor (arrow, lower picture).
Start engine and allow it to idle.

Measure CO content.
Set value: see brief instructions

Is set value attained?

N>

CO CONTENT TOO HIGH

Use ohmmeter to test following lead for short-circuit to ground.
Set value: infinity Ω

From control-unit plug term. 24 to control-unit plug term. 5.

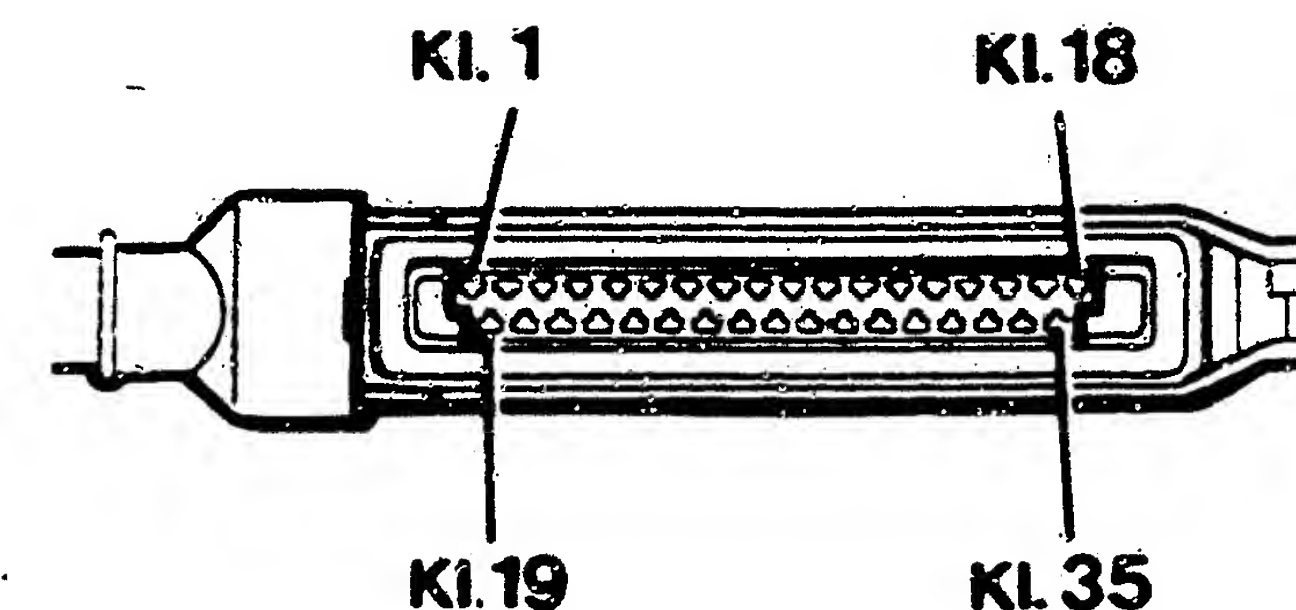
If set value is attained, renew control unit.

CO CONTENT TOO LOW

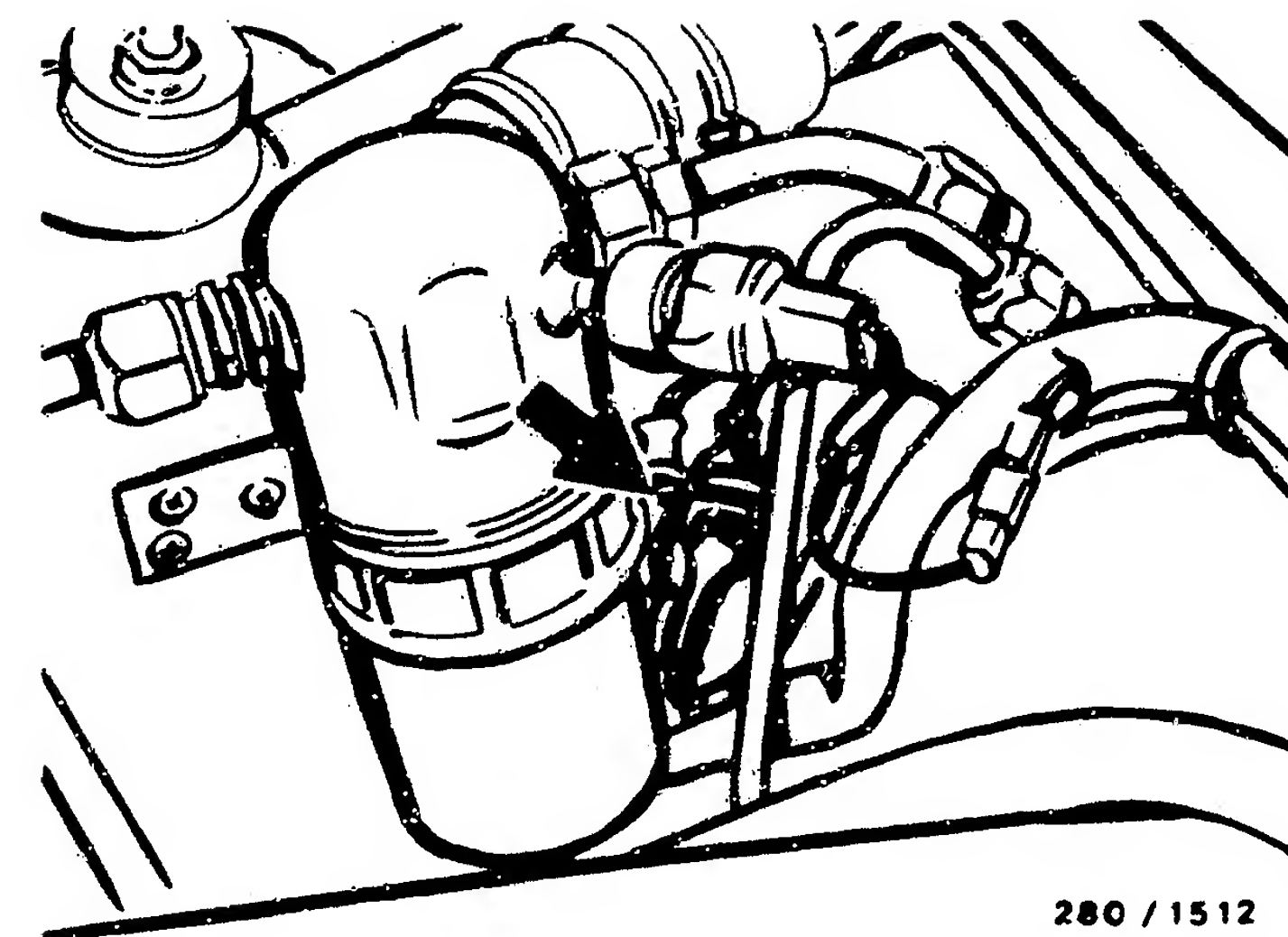
Use ohmmeter to test following lead for short-circuit to U Bat .

From control-unit plug term. 24 to control-unit plug term. 4.

If set value is attained, renew control unit.



227/925



280 / 1512

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (2)

Test closed-loop control function
of control unit.

Run engine at idle speed.

Hold lambda-sensor lead to control
unit against vehicle ground.

Set value: CO content increases.

Hold lambda-sensor lead to control
unit against positive terminal of
1.5 V battery and negative terminal
of battery against vehicle ground.

Set value: CO value decreases.

Are set values attained?

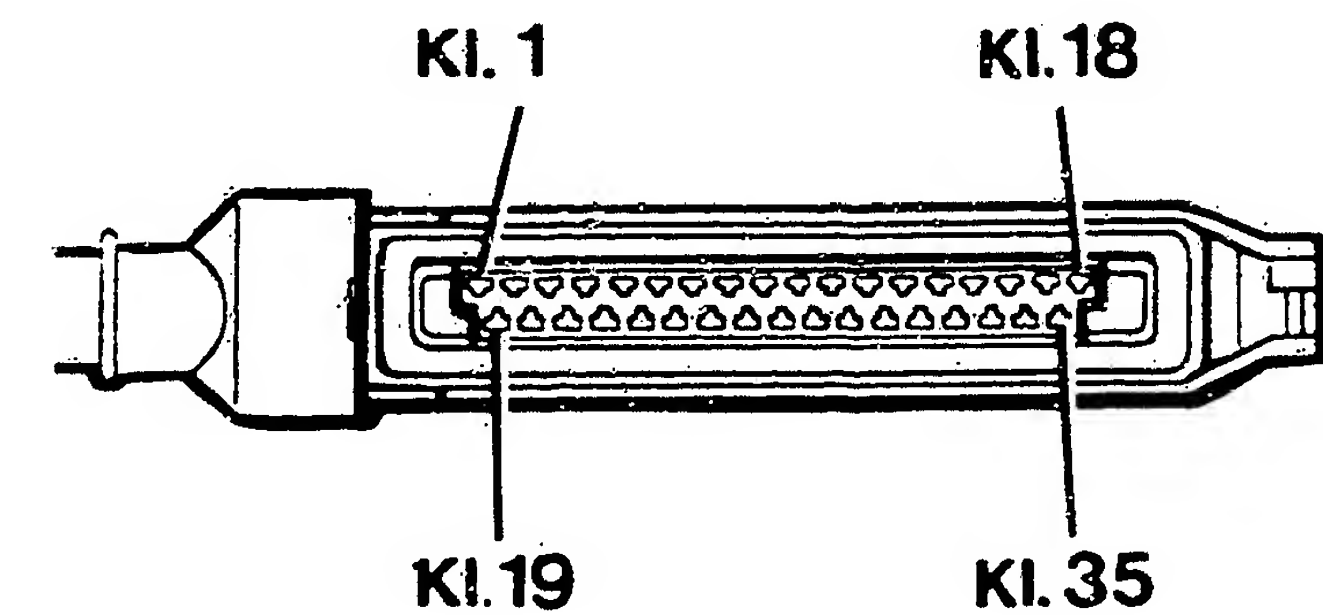
N>

Use ohmmeter to test following lead
for continuity.

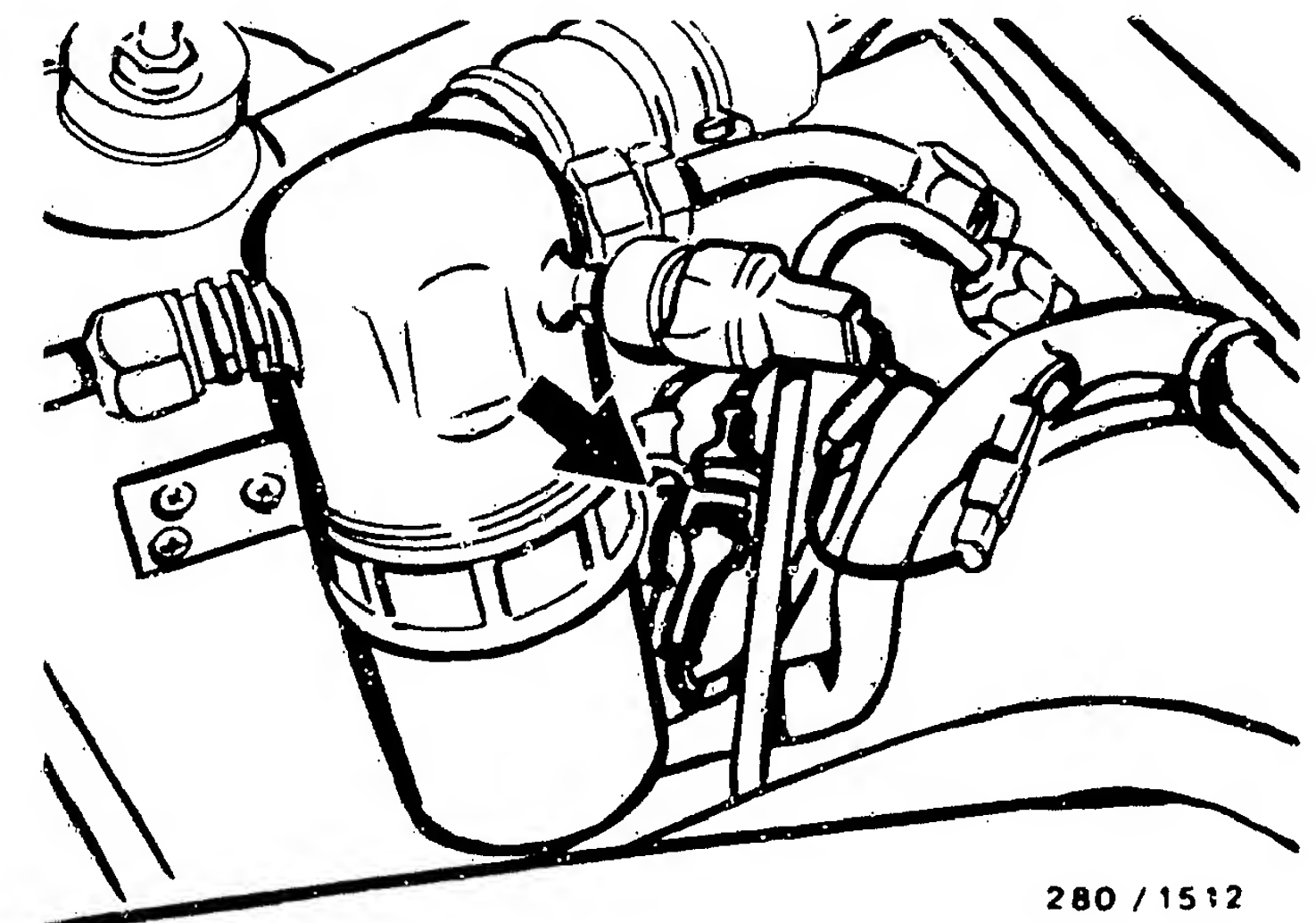
Set value: approx. 0 Ω

From control-unit plug term. 24
to plug connection of lambda
sensor.

If lead is O.K., renew control unit.



227/925



280 / 1512

Continued on next picture page

F01

<=>

F02

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (3)

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.

Disconnect pump relay.

Connect jumper into connection base between term. 87 and term. 30.

The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery

SET VALUE: See brief instructions

Set value obtained?

N>

*Fuel filter very dirty
→ replace.

*Fuel delivery line or pressure damper (if applicable) clogged → replace.

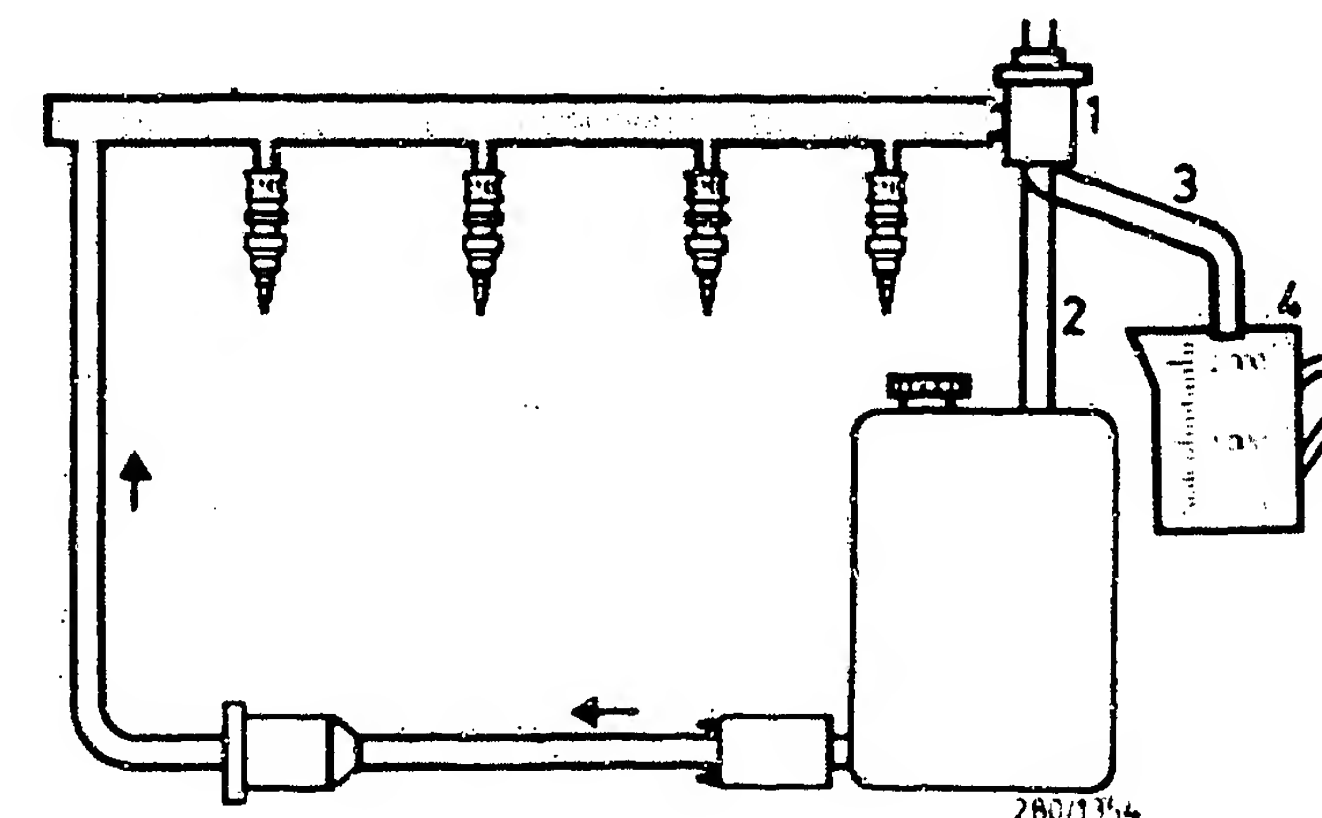
*Voltage at electric fuel pump, with engine running, min. 12 V. If not, clean contacts, eliminate poor ground connection, replace leads.

*Check pre-supply pump (if applicable). Measuring point: line between the pumps. Fuel delivery must be at least 10% greater than that of the electric fuel pump. If not → replace pre-supply pump.

*If fuel-pump delivery too low → replace electric fuel pump. Clean joints before loosening so that no dirt gets into the fuel system. In-tank electric fuel pumps are accessible via a closure on the tank.

*If electric fuel pump loud (vapor locks) intake line constricted or kinked → replace. Strainer in tank clogged → replace. Corrosion in tank → clean/replace.

*Pressure regulator defective - check.
See next coordinate:



Pressureless

Fuel pressure

1 = Pressure regulator

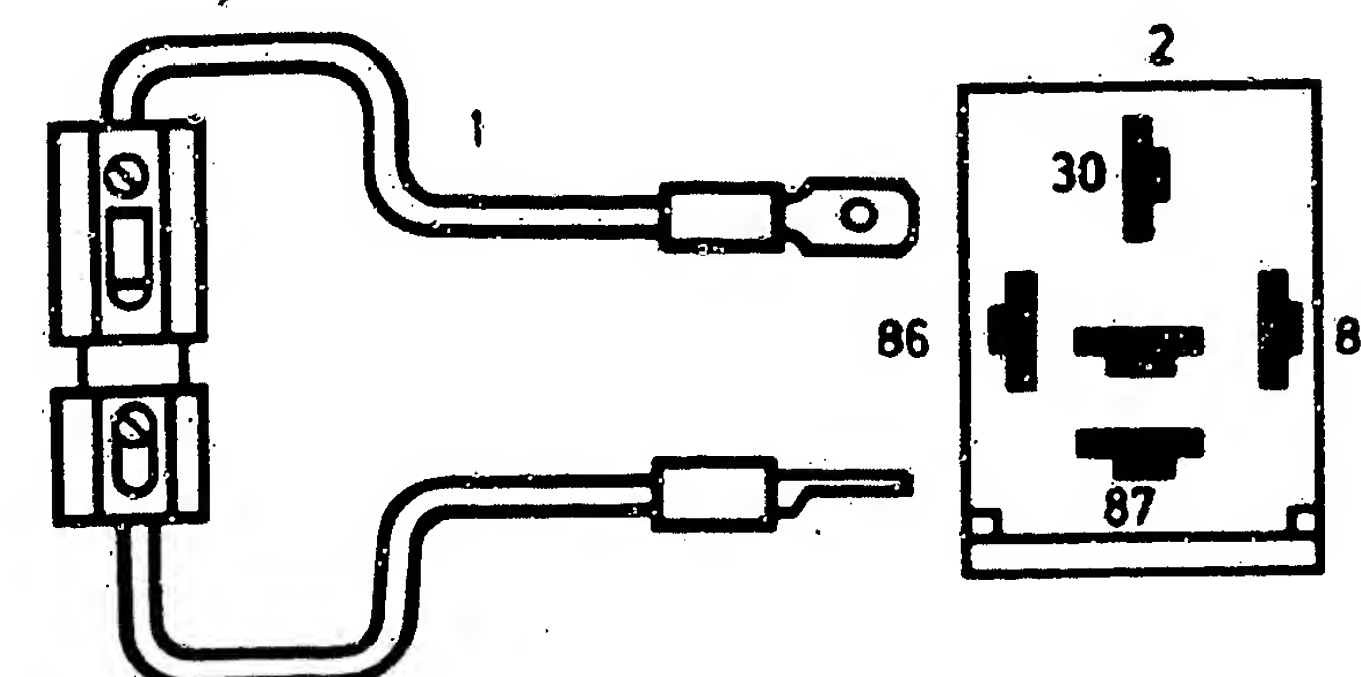
2 = Return

3 = Test hose

4 = Measuring glass

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (4)

Check fuel pressure with engine stopped.

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

CAUTION!

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5). Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

N>

Set value not reached:

*Slowly pinch off fuel return line. Caution! Do not allow pressure to exceed 6 bar. Renew pressure regulator if pressure exceeds 5 bar. Use new O-rings in the case of O-ring sealing technique. Apply a small quantity of engine oil (e.g. HD 30). If pressure does not increase sufficiently: fuel pump defective, renew.

*Fuel filter heavily contaminated, renew.

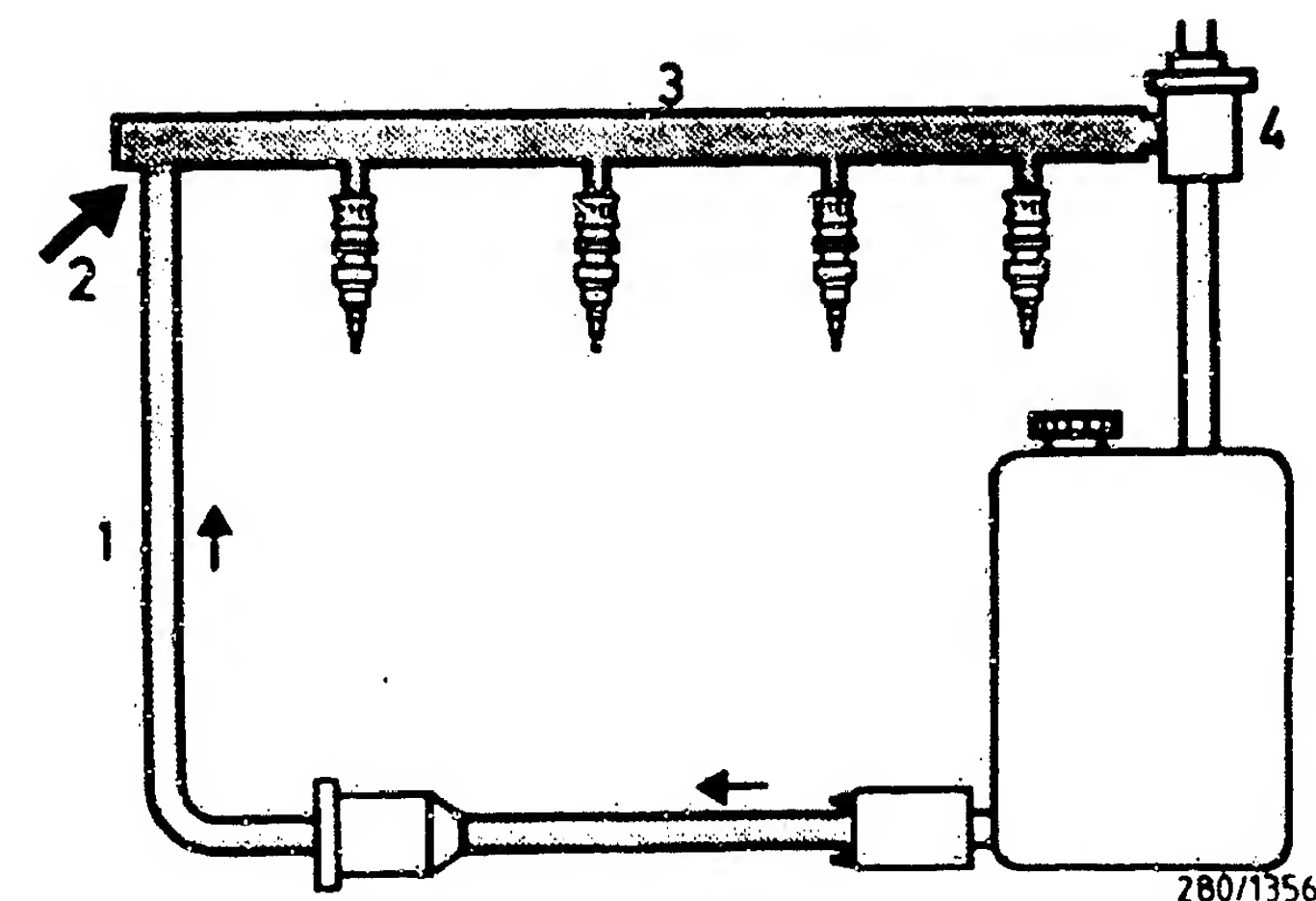
*Fuel delivery line or pressure damper (if provided) clogged, renew.

*Strainer in tank clogged. Corrosion in tank.

Set value exceeded:

Detach fuel return hose from pressure regulator. Attach test hose to pressure regulator and route it into a 1.5l measuring jug. Is set value now attained?

*If yes, fuel return line clogged or pinched off, renew.
*If not, pressure regulator defective, renew.

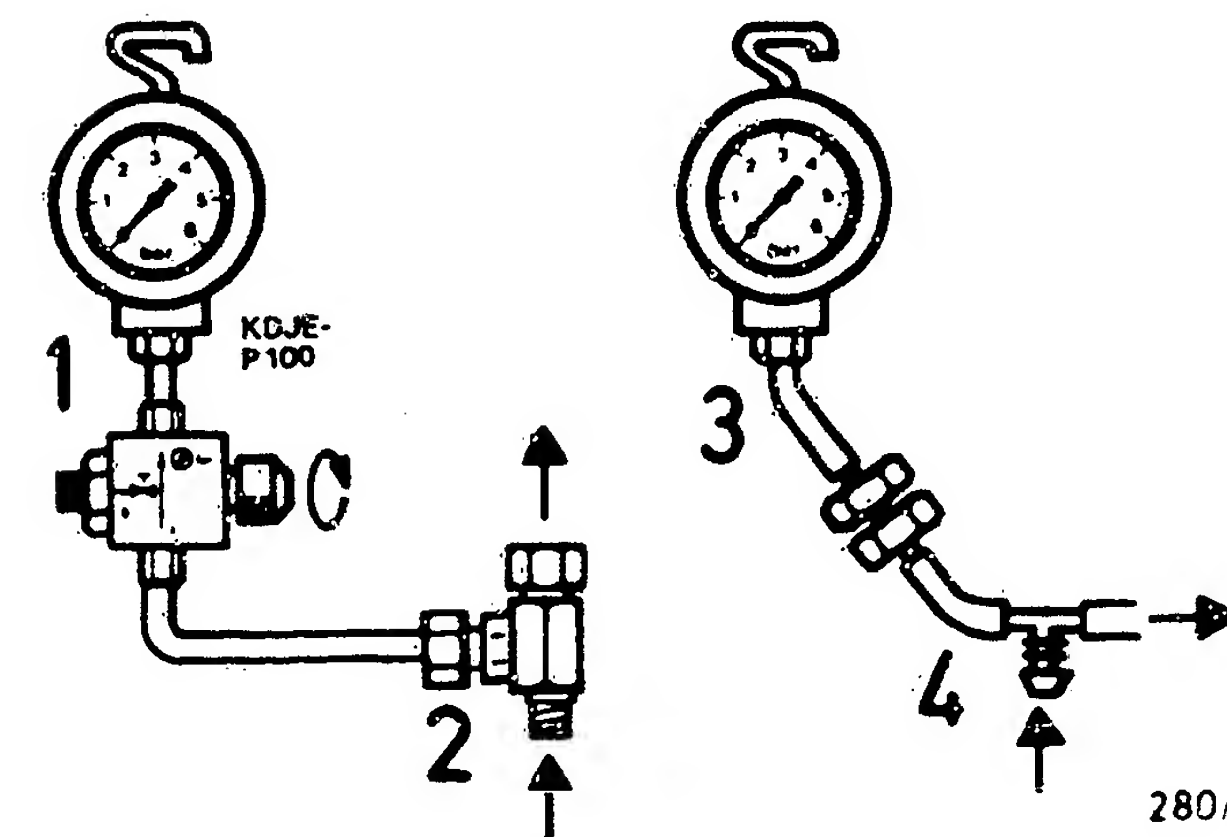


Pressureless

Fuel pressure

1 = Inlet, delivery line
2 = Measuring point
3 = Fuel-distribution pipe
4 = Pressure regulator

1 = Pressure tester
2 = Connec. part KDJE-P100/14
3 = Pressure gauge with hose line
4 = Three-way line KDJE-P100/13



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (5)

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure
SET VALUE: approx. 0.5 bar
lower than with engine stopped.

Set value obtained?

N>

*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking -> replace.
Hose line dropped off -> re-connect.

*If intake-manifold-pressure energization O.K. -> replace pressure regulator.

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure
SET VALUE: min. 1.0 bar
after 20 minutes.

Set value obtained?

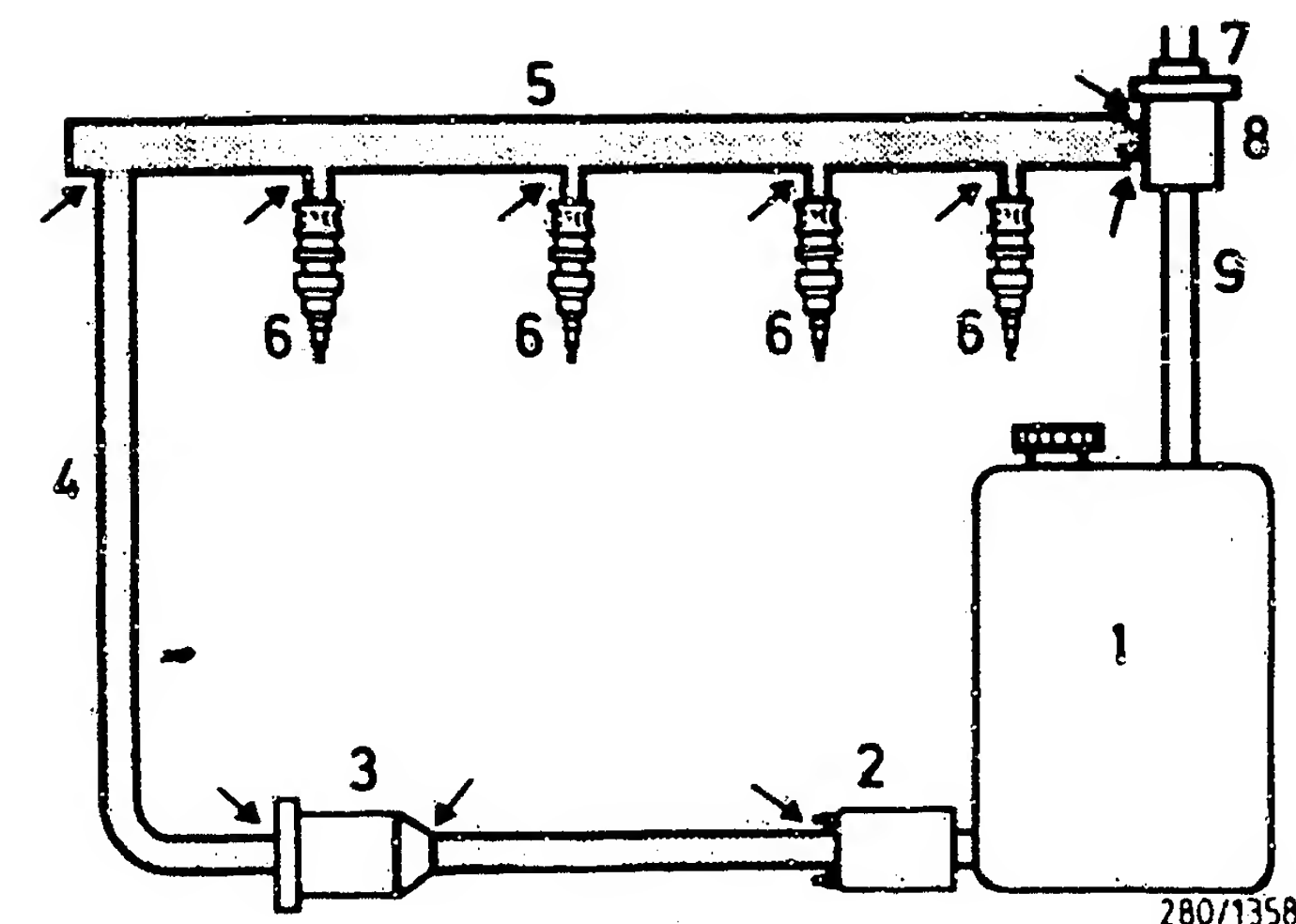
N>

*Leaking at joints between components, fuel hoses and fuel lines -> tighten hose binder or replace hose.

*Pressure regulator (diaphragm) leaking -> replace.

*Electric fuel pump (non-return valve) leaking.
With screw-type non-return valve -> replace.
With integral non-return valve -> replace electric fuel pump.

*Pressure damper or fuel filter leaking -> replace.



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks

Continued on next picture page

Continued on next picture page

*Leak in injection valve(s)
at point of connection with
fuel distributor; renew
O-ring. See text below.

*Check injection valve(s)
(needle seat) for leaks:

Remove complete fuel distributor.
Supply and return remain
connected. Simultaneously
pull all injection valves
out of intake-manifold guide.

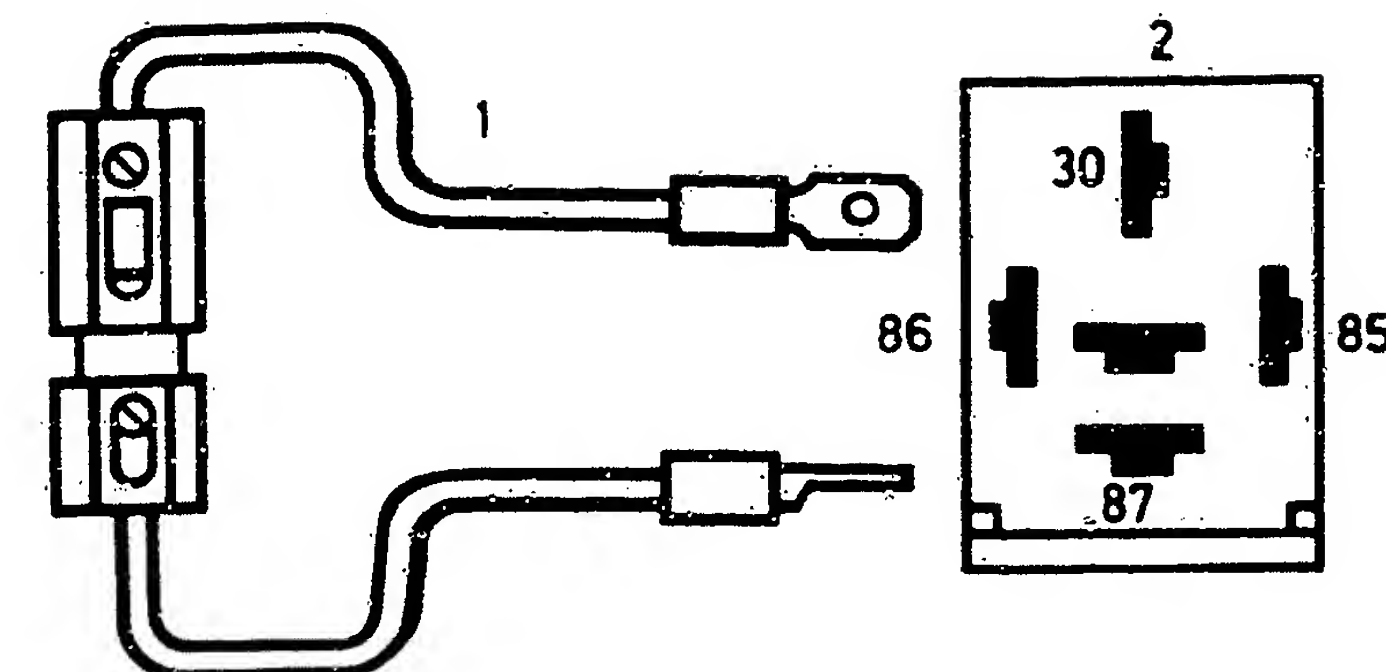
Fit jumper between term. 87
and term. 30 in connection
frame (pump relay).
Electric fuel pump must
run.

Set value:

No droplets may drip off the
injection valve within 60 s.
If they do so, renew injection
valve.

Removal:

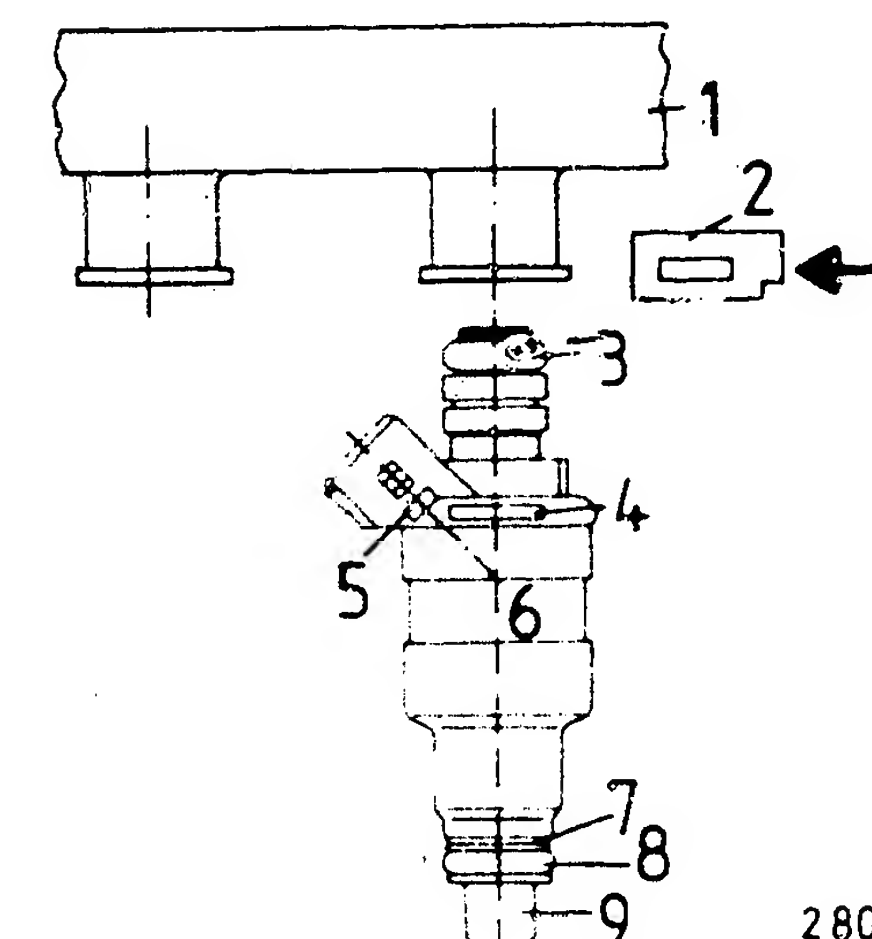
Detach connector.
Pull out retaining clip.
Remove injection valve.
Caution!
Catch any fuel which emerges.
It must not be allowed to make
contact with hot engine components.



280/1359

1 = Jumper with fuse holder
and 10 A fuse (user-
fabricated)
2 = Top view of connection
base

1 = Fuel-distribution pipe
2 = Holding clamp
3 = Upper O-ring
4 = Part number
5 = Date of manufacture
6 = Injection valve
7 = Supporting plate
8 = Lower O-ring
9 = Protective sleeve



280/1360

Continued on next picture page

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (7)

If there is no injection valve leakage (needle seat), but O-ring is defective, renew O-ring.

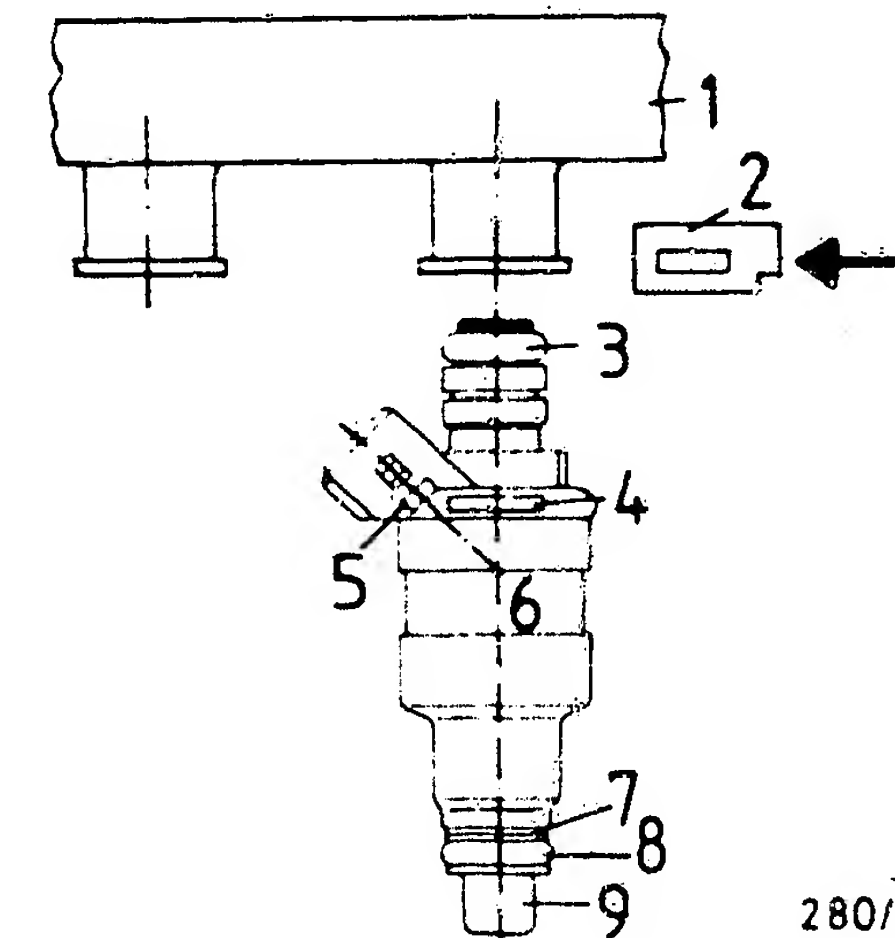
Use new parts set.
Caution! Do not damage protective sleeve and valve needle

If upper O-ring (fuel distribution pipe) is damaged, renew it.

If lower O-ring (intake manifold) is defective, cut it up.
Fit new O-ring over protective sleeve and its beading.

Fitting:
Slightly lubricate O-rings only with engine oil (e.g. HD 30).
Attach injection valve to fuel distribution pipe.
Insert retaining clip into groove and engage it.
Test for fuel leakage.
Attach connector.

Fit complete fuel distribution pipe. In doing so, simultaneously press all injection valves into intake manifold guide.
Important!
Do not damage O-rings or valve needles.
Make sure intake manifold is not leaking.



280/1360

- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = Date of manufacture
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.
Connect fuel-inlet hose to fuel-distribution pipe.
Make sure there are no leaks.

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (8)

Check air-intake system

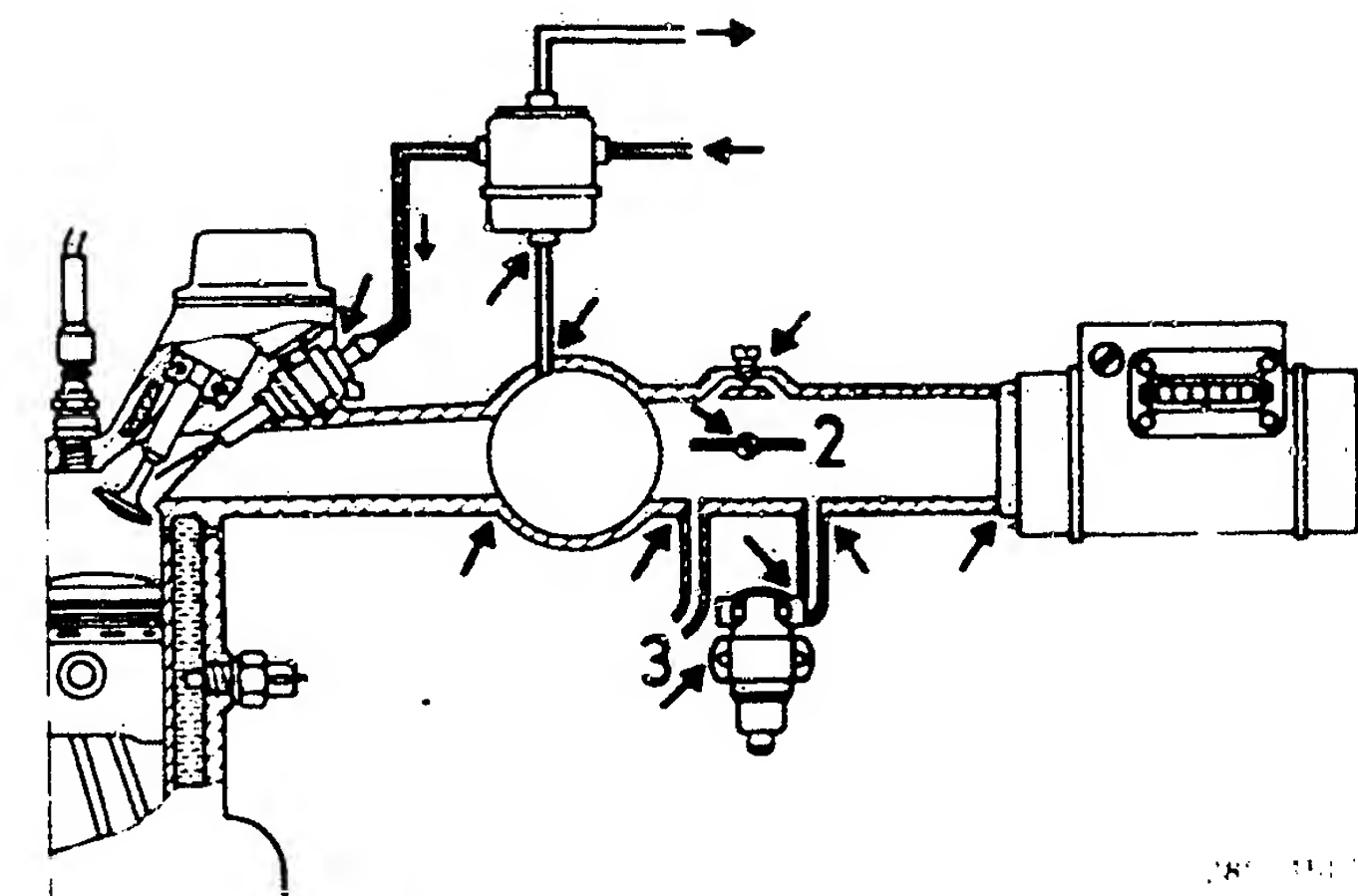
Are all hoses correctly connected, not kinked or damaged?
Is oil dipstick pressed all the way in? Is lid seal on oil filler neck O.K.?

Are all hoses O.K.?

N>

Replace hoses if necessary.
Re-tighten hose binders.

Push in oil dipstick firmly.
Replace lid seal on oil filler neck.



1 = Sealing
2 = Open throttle valve fully
3 = Blow in air
Small arrows = Possible leaks

Leak test

Seal tail pipe.
Unscrew air-mass meter from air-filter housing and seal air-mass-meter duct.
Detach hose downstream of idle actuator and seal idle-actuator connection.
Fully open throttle valve.

Use compressed-air gun to blow air (0.3 bar gauge pressure) into intake manifold.
Spray or brush over all seals with leakage detector spray or soapy water.

Are all points leakproof?

N>

Bubbling or foaming indicates a leak.

Eliminate leaks by new seals or by re-tightening the hose binders.

Leaks may also occur at the following points:
Throttle-valve mounting, intake-manifold gasket as well as auxiliaries (e.g. brake booster) that work on intake-manifold pressure.

Continued on next picture page

Test solenoid-operated injection valves.

Detach plugs at solenoid-operated injection valves.

Connect ohmmeter to solenoid-operated injection valve.
Perform test at all injection valves.

Set value: see brief instructions

Is set value attained?

N>

Renew respective solenoid-operated injection valve.

Removal:

Detach connector.

Pull out retaining clip.

Remove injection valve.

Caution!

Catch fuel as it emerges; it must not be allowed to get on to hot parts of engine.

Fitting:

Only oil O-rings slightly (engine oil HD 30).

Attach injection valve to fuel distributor.

Insert retaining clip into groove and engage it.

Test for fuel leaks.

Attach connector.

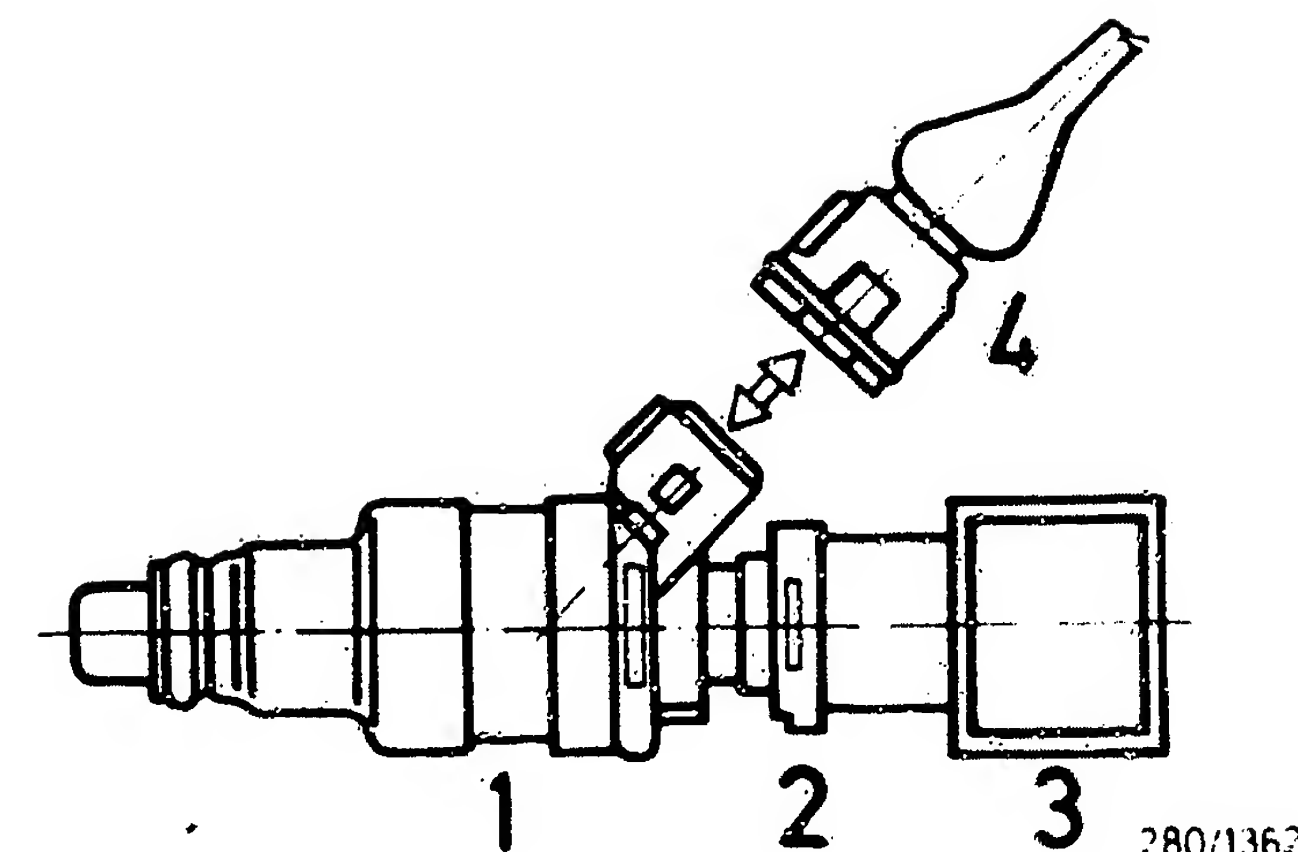
Install complete fuel distributor.

In doing so, press all injection valves simultaneously into intake-manifold guide.

Caution!

Never damage O-rings or valve needle.

Ensure that there are no intake-manifold leaks.



1 = Injection valve

2 = Holding clamp

3 = Fuel-distribution pipe

4 = Connector

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (10)

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

Set value: approx. 0 Ω

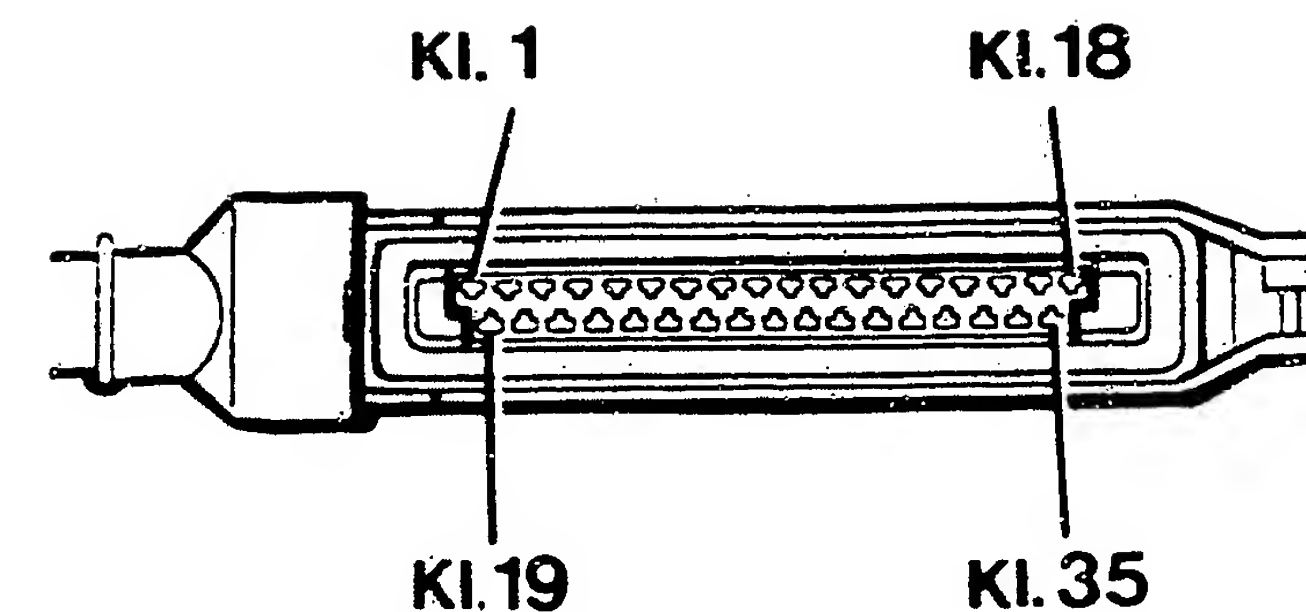
From control-unit plug term. 18 to connector of injection valve.

From pump relay term. 87 to connector of injection valve.

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/925

Detach connectors of solenoid-operated injection valves.

Switch on ignition

Measure voltage at connector term. 2 with respect to vehicle ground.

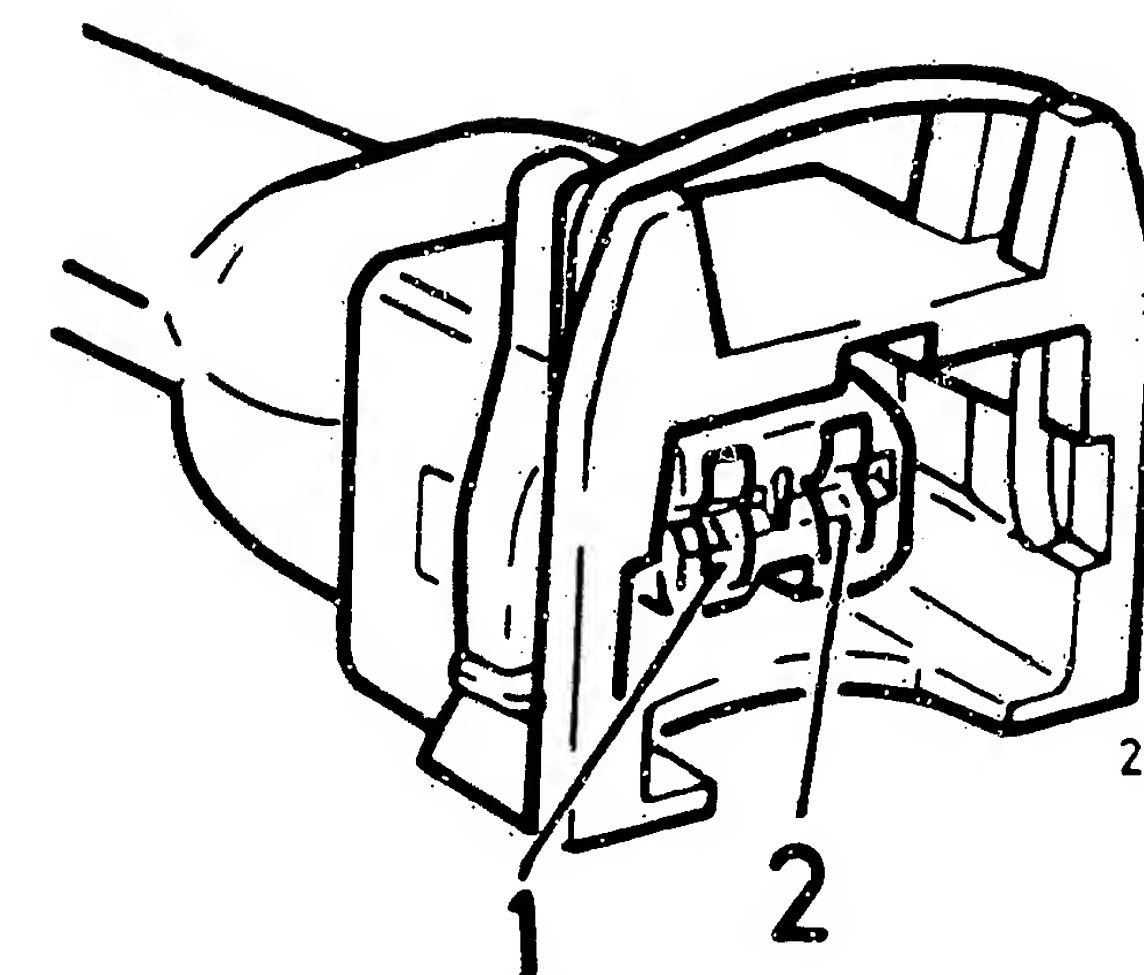
Perform test on all connectors.

Set value: 8...15 V

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/1036

Renew control unit.

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (11)

Check solenoid-operated injection valves with engine running.

With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

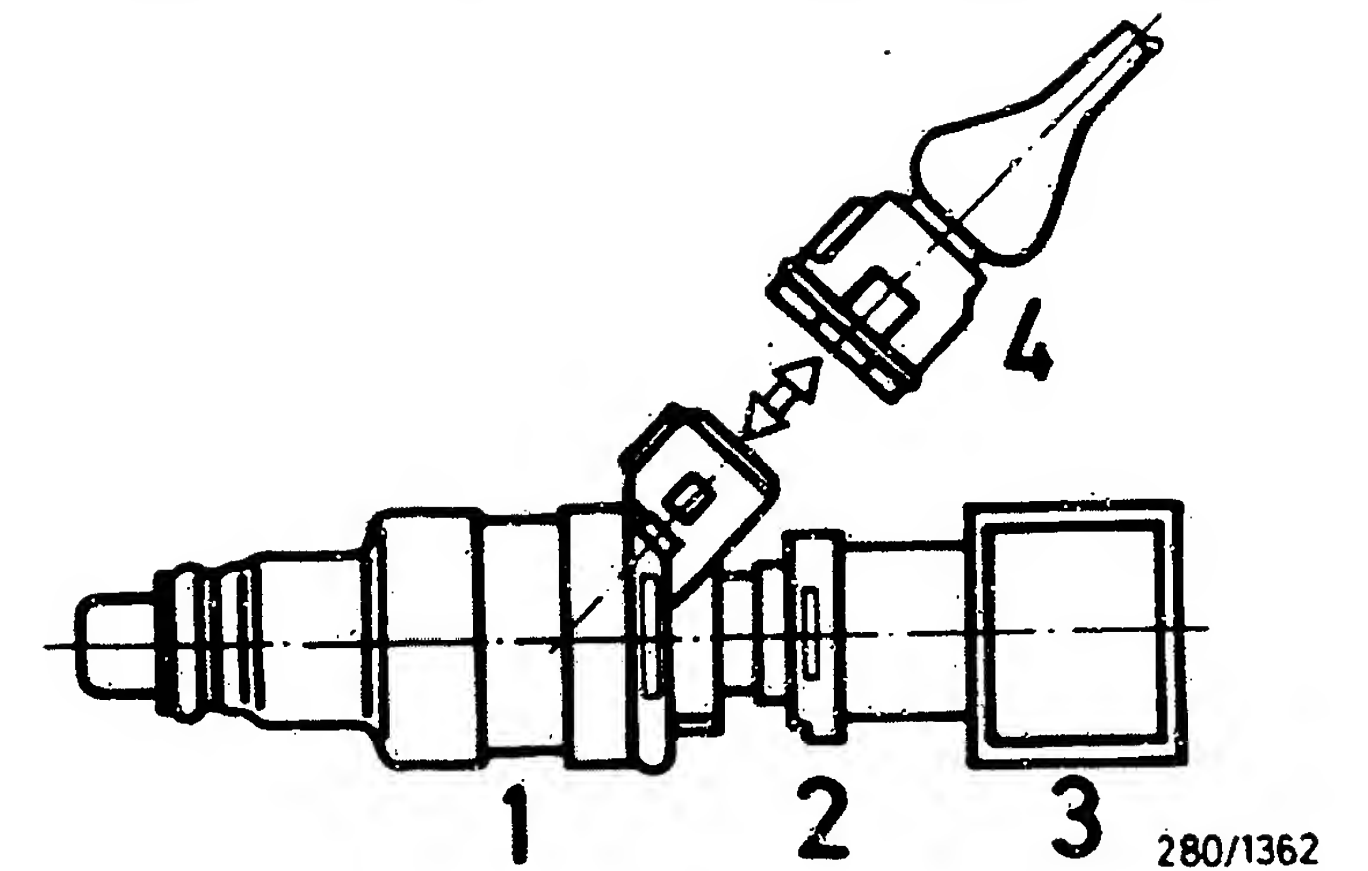
Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?

N>

No drop in engine speed =>
Replace injection valve
in question.



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

Return to self-diagnosis
test table B17

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (14)

SELF-DIAGNOSIS FLASHING CODE 311

Speed signal

Use ohmmeter to test following lead
for continuity.

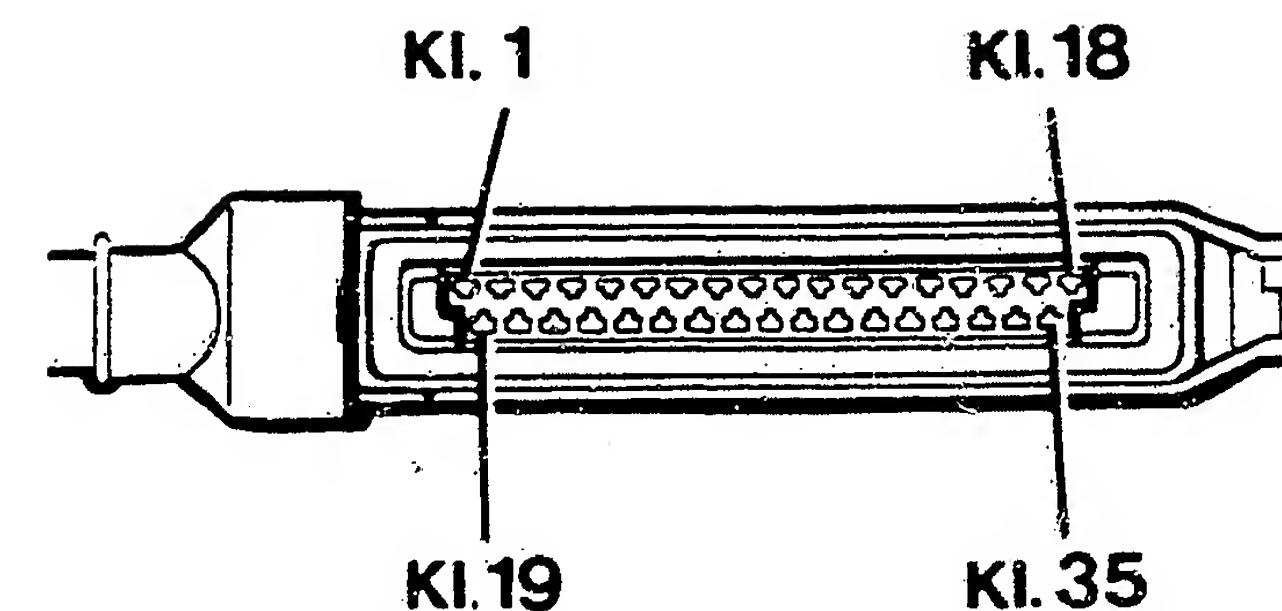
Set value: approx. 0 Ω

From control-unit plug term. 34
to speed sensor.

Is set value attained?

N>

If lead is O.K., renew speed sensor.



227/925

Return to self-diagnosis
test table B17

F21

<=>

F22

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (15)

SELF-DIAGNOSIS FLASHING CODE 312

Test knock enrichment input.

Use ohmmeter to test following lead for continuity.

Set value: approx. 0 Ω

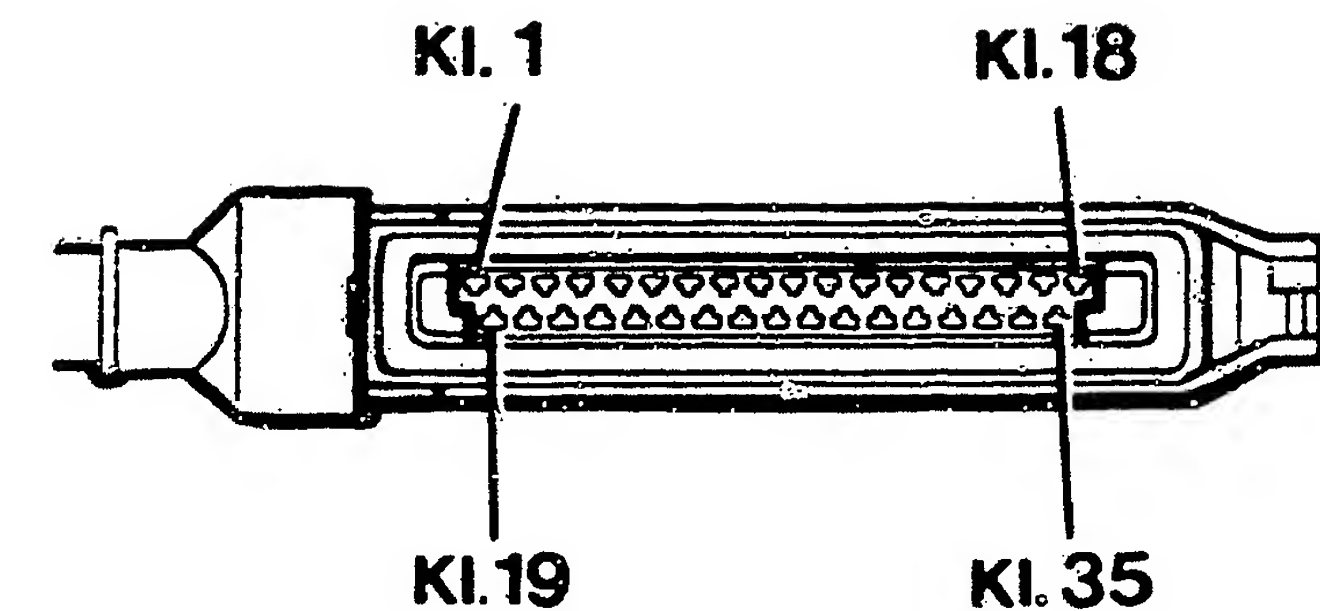
From control-unit plug term. 28
to ignition-control-unit plug
term. 4.

Is set value attained?

N>

Repair faulty lead or plug.

Check ignition system/ignition
control unit.



227/925

Return to self-diagnosis
test table B17

F23

<=>

F24

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (16)

SELF-DIAGNOSIS FLASHING CODE 322

Test self-cleaning function of hot-wire air-mass meter.

Push back rubber sleeve at connector of hot-wire air-mass meter.

Connect voltmeter with test prods to term. 4 (+) and term. 1 (-).

Set value: 2...5 V for approx. 1 s

Prior to measurement, engine must run at in excess of 2000 min⁻¹ and the engine temperature must be greater than +60°C. Then ignition "OFF" - voltage reading after approx. 4 s.

Is set value attained?

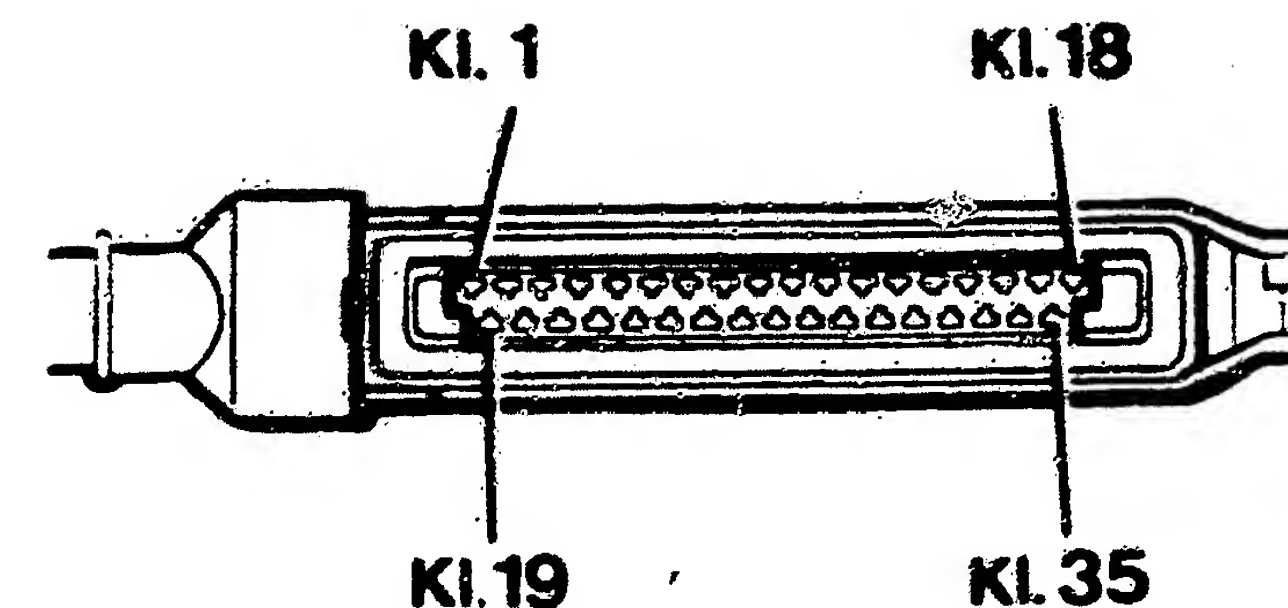
N>

Use ohmmeter to test following lead for continuity.

Set value: approx. 0 Ω

From control-unit plug term. 8 to hot-wire air-mass meter term. 4.

If lead is O.K., renew control unit.



227/925

Return to self-diagnosis test table B17

F25

≡

F26

≡

SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (1)

SWITCHING-INPUT DIAGNOSIS - IDLE SWITCH

Detach plug at throttle-valve
switch.
Connect ohmmeter to throttle-valve
switch term. 2 and term. 18.

Set values:
Throttle valve closed: 0 Ω
Throttle valve open: 0 Ω

Are set values attained?

N>

Trouble-shooting:

Prerequisite: throttle valve is
correctly set.
Lever must make contact with
adjusting screw shortly prior
to end position.
Secure against turning.
* Set accelerator cable/linkage
such that there is no tension.
* If kinked => renew.

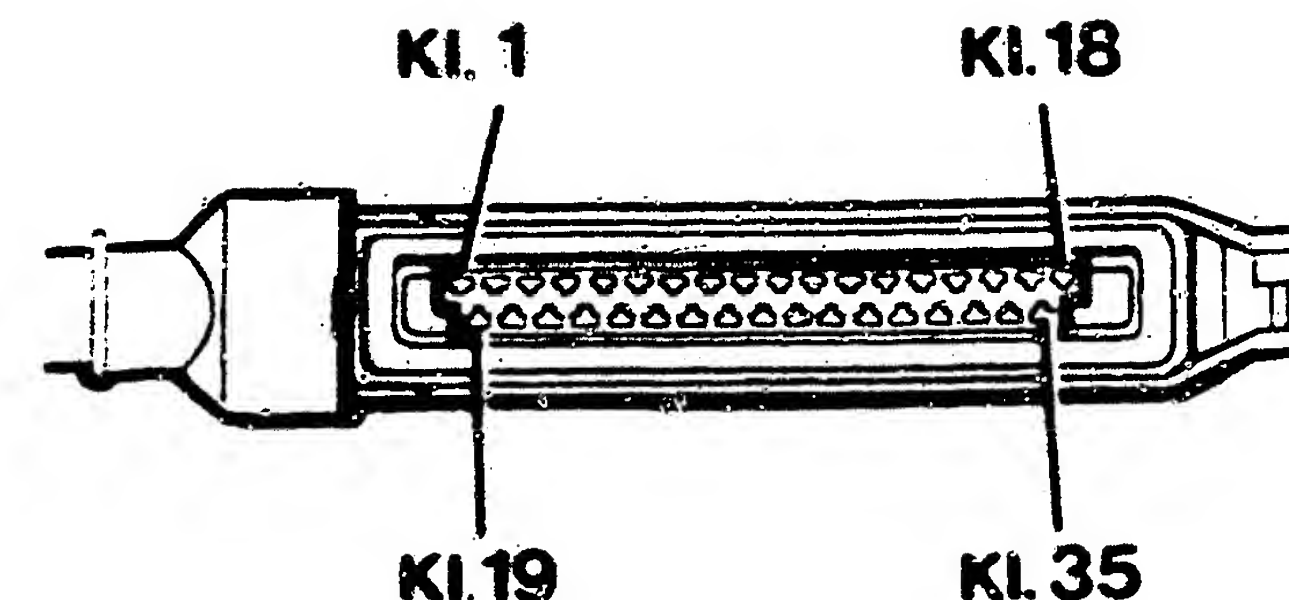
Adjustment of throttle- valve switch

Loosen fastening screws somewhat.
Connect ohmmeter to throttle-
valve switch between term. 2 and
term. 18. Turn throttle-valve
switch until idle contact makes
(microswitch is heard to click).
Reading 0 Ω . If not => renew
throttle-valve switch.

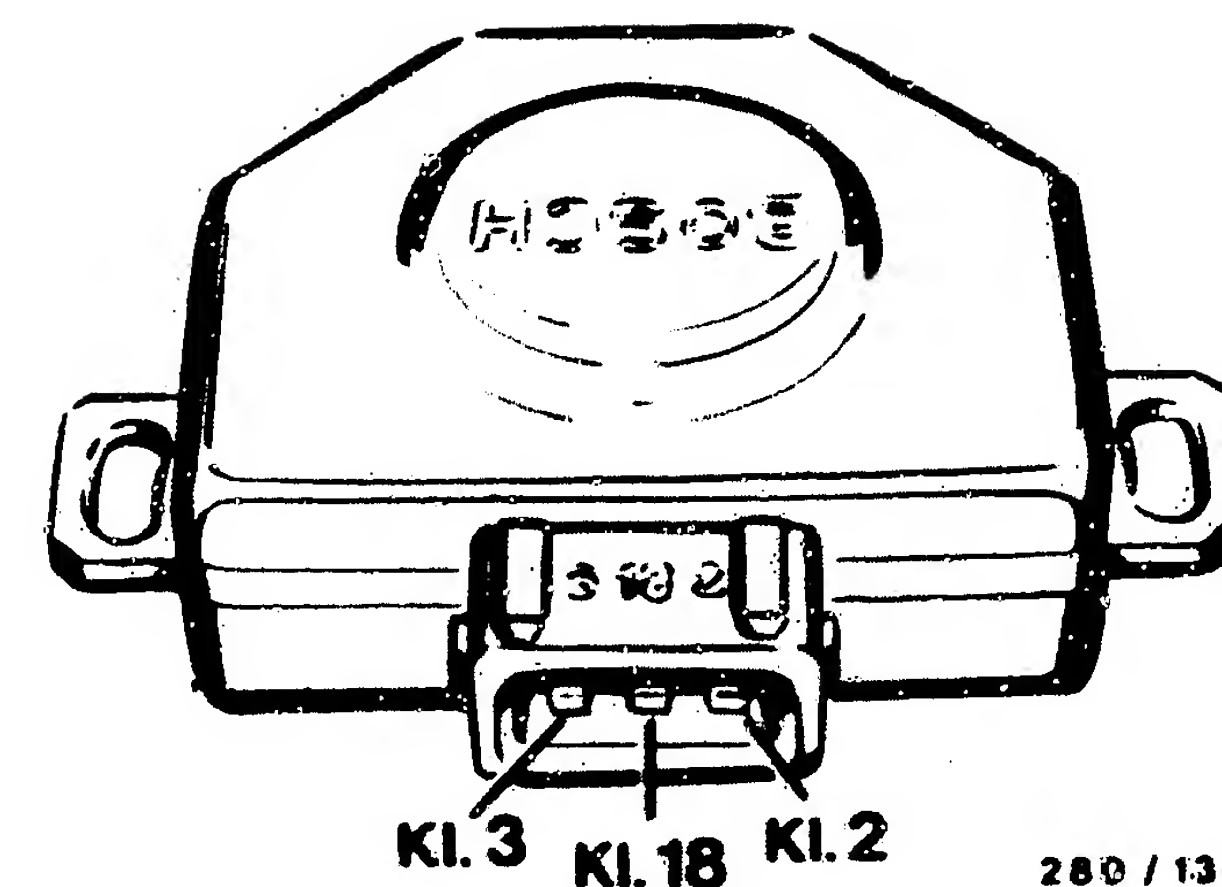
Adjustment check:

Tighten accelerator cable
somewhat. The idle contact opens
(microswitch is heard to click).
Reading: infinity Ω .
Use ohmmeter to check following
leads for continuity
Set value approx. 0 Ω :

- * From throttle-valve switch
term. 2 to control-unit plug
term. 2
- * From throttle-valve switch
term. 18 to vehicle ground.
Eliminate open-circuits/contact
resistances.



227/925



280/1347

Return to switching-input-diagnosis
test table B19

SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (2)

SWITCHING-INPUT DIAGNOSIS - FULL-LOAD SWITCH

Detach plug at throttle-valve
switch.
Connect ohmmeter to throttle-
valve switch term. 3 and term. 18.

Set values:
Throttle valve closed: infinity Ω
Throttle valve fully open:
infinity Ω

Are set values attained?

N>

* Resistance remains continuously
on 0 Ω (full-load contact does
not open):
Renew throttle-valve switch.

* Full-load contact does not make
(reading remains constantly on
infinity Ω):
Test whether throttle valve can
be fully opened by mechanical means.
If mechanical system is O.K.,
renew throttle-valve switch.

N o t e :
Full-load contact cannot be
adjusted. If idle contact is
correctly set, the setting of the
full-load contact is likewise
correct.

Repair defective lead/plug.

N>

Use ohmmeter to test following leads
for continuity.
Set value: approx. 0 Ω

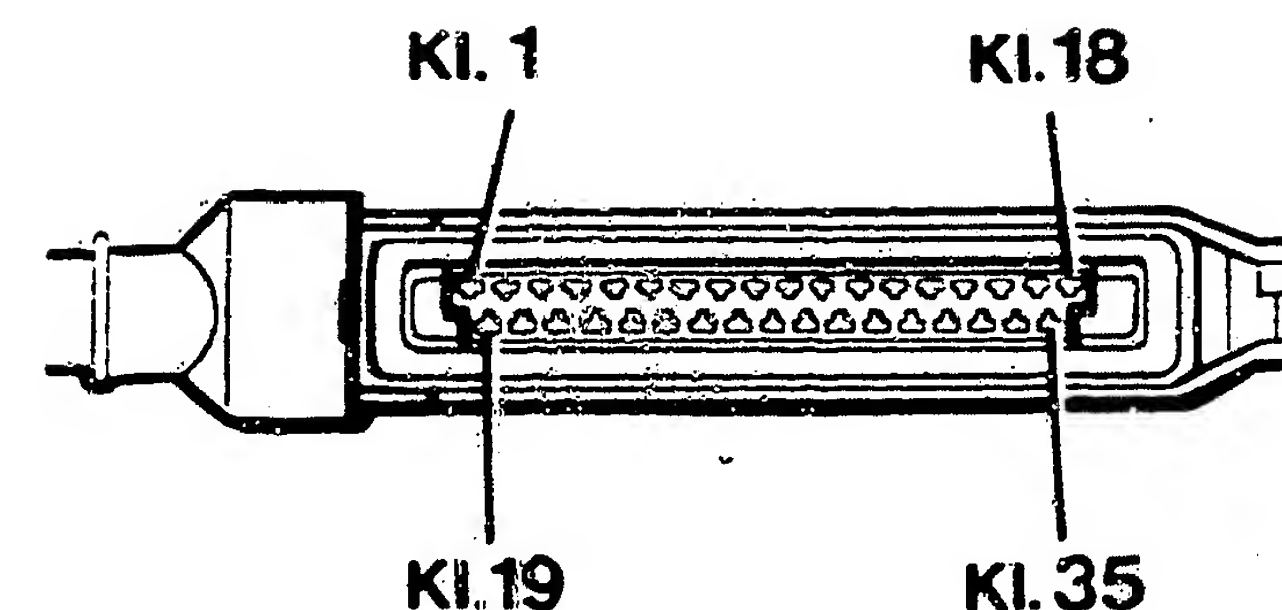
From control-unit plug term. 3
to throttle-valve switch term. 3.

From throttle-valve switch
term. 18 to vehicle ground.

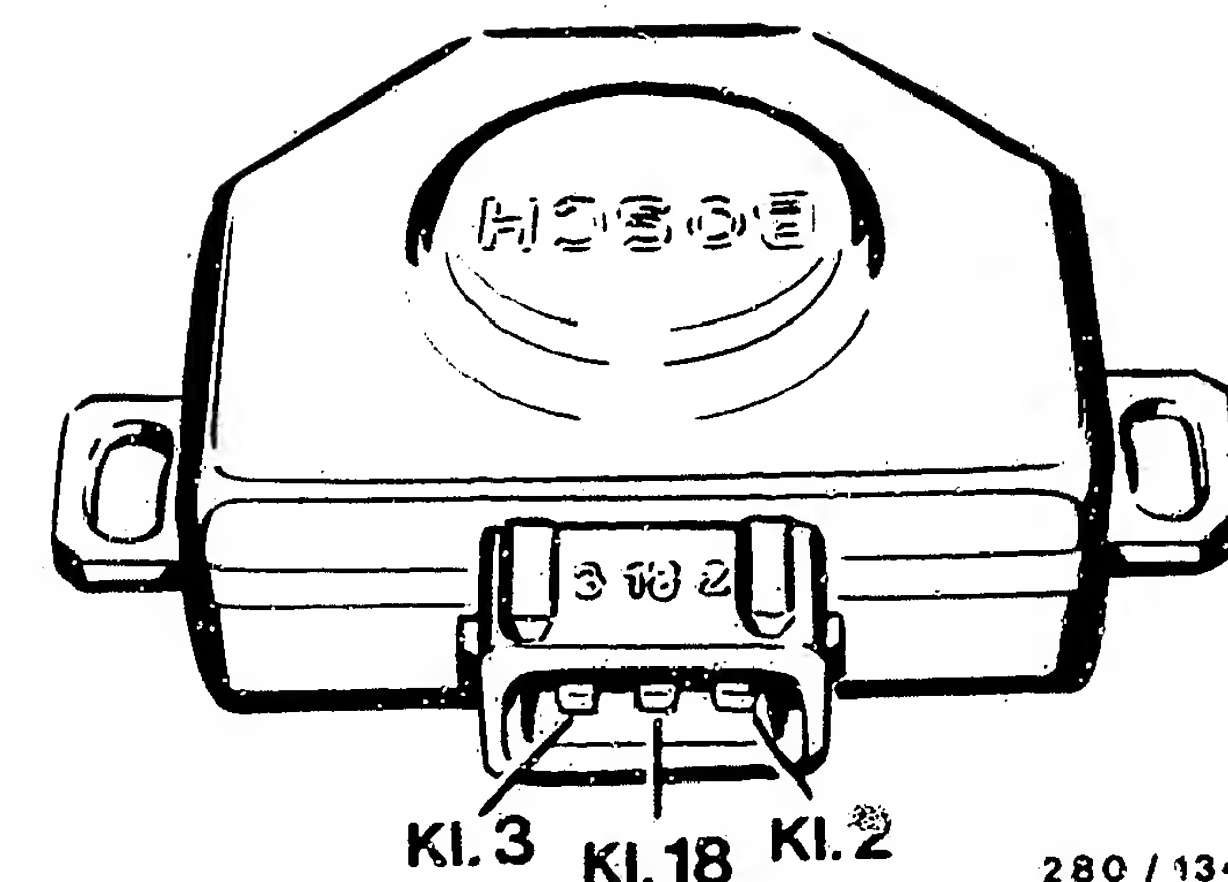
Watch out for worn cable insulation
and loose contacts.

Is set value attained?

Return to switching-input-diagnosis
test table B19



227/925



280/1347

G01

<=>

G02

<=>

SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (3)

SWITCHING-INPUT DIAGNOSIS - ENGINE-SPEED SIGNAL

Detach control-unit plug.

Set Motortester to special input.
Lever on left stop.
(Calibrated voltage range).

Red tester terminal to control-
unit plug term. 1.
Black tester terminal to vehicle
ground.

Start engine.

Set value: see bottom picture

Is set value attained?

N>

Detach control-unit plug.

Use ohmmeter to test following lead
for continuity.

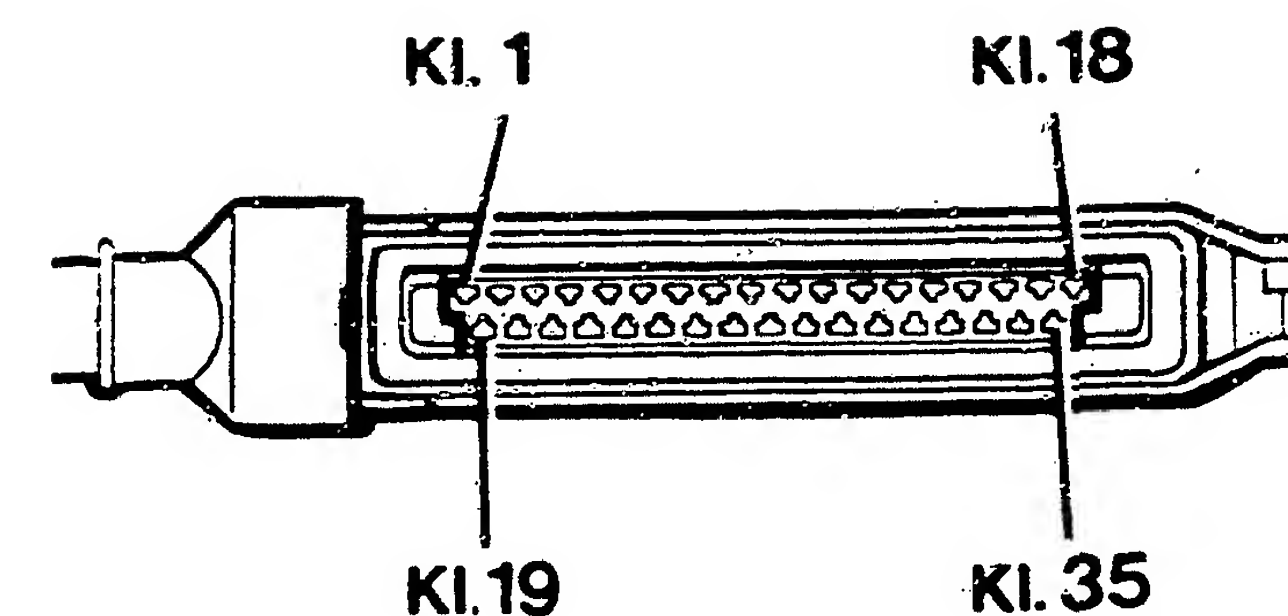
Set value: approx. 0 Ω

From control-unit plug term. 1
to ignition coil term. 1

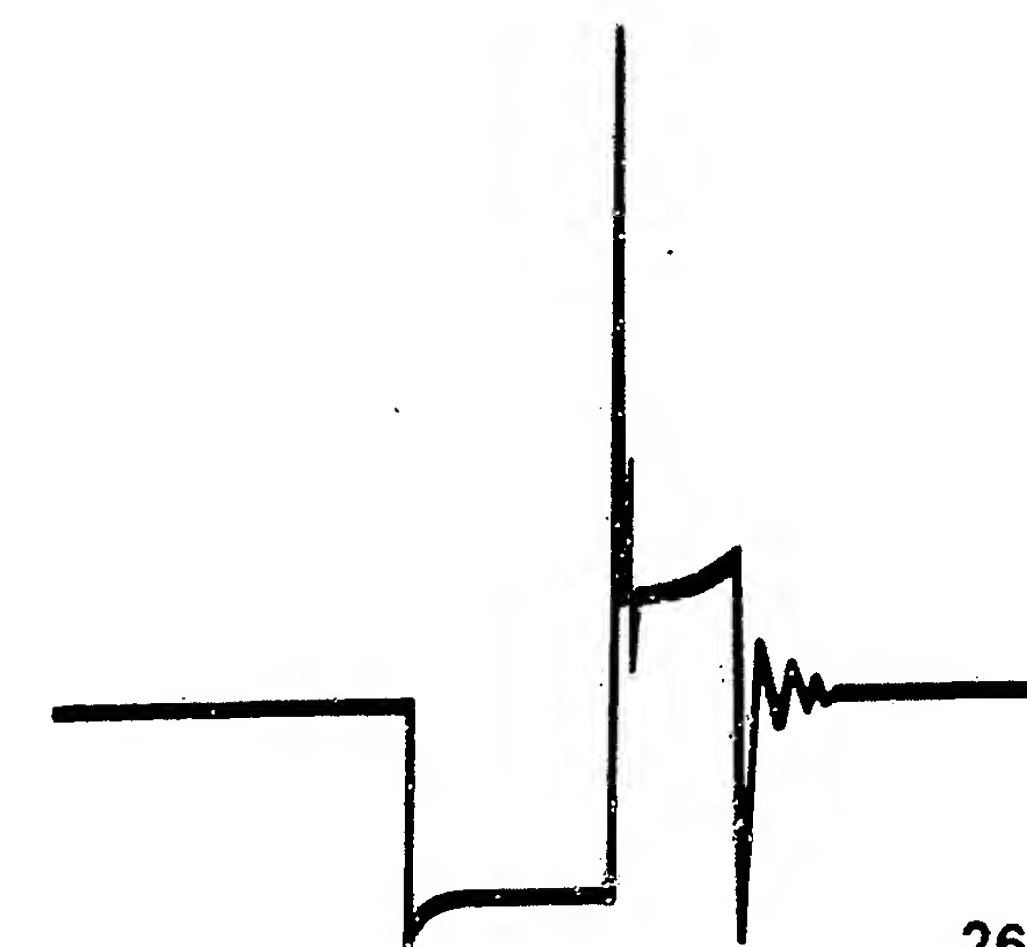
With TD signal from control-unit
plug term. 1 to ignition control
unit term. 17.

If leads are O.K., check ignition
system.

Repair faulty lead or plug.



227/925



261 / 0212

Return to switching-input-diagnosis
test table B19

280/0831

G03

<=>

G04

<=>

SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (4)

SWITCHING-INPUT DIAGNOSIS - A/C STANDBY SWITCH

Detach control-unit plug.

Connect voltmeter with test prods
to control-unit plug term. 15 and
term. 5.

Switch on ignition
Switch on A/C standby switch.

Set value: 8...15 V.

Is set value attained?

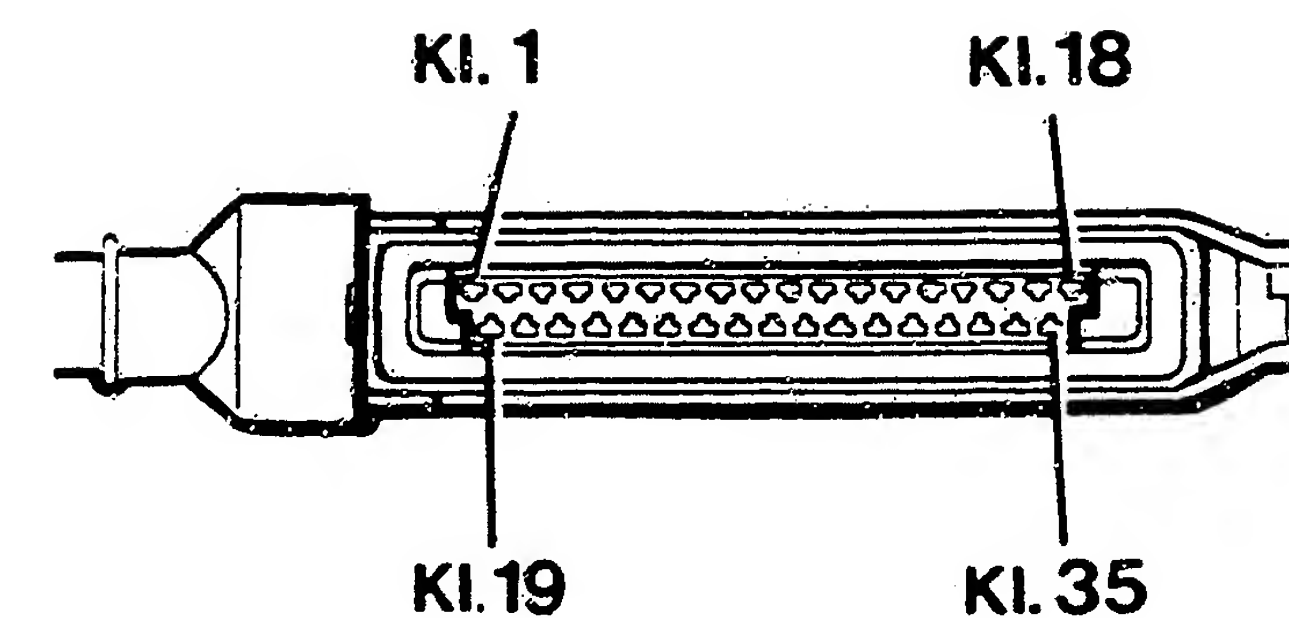
N>

Use ohmmeter to test following leads
for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 15
to A/C standby switch

From ignition and starting switch
term. 15 to A/C standby switch

If leads are O.K., renew A/C
standby switch.



227/925

Renew control unit.

Return to switching-input-diagnosis
test table B19

G05

<=>

G06

<=>

SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (5)

SWITCHING-INPUT DIAGNOSIS - A/C COMPRESSOR SWITCH

Detach control-unit plug.

Connect voltmeter with test prods
to control-unit plug term. 14 and
term. 5.

Switch on ignition.
Switch on A/C compressor switch.

Set value: 8...15 V

Is set value attained?

N>

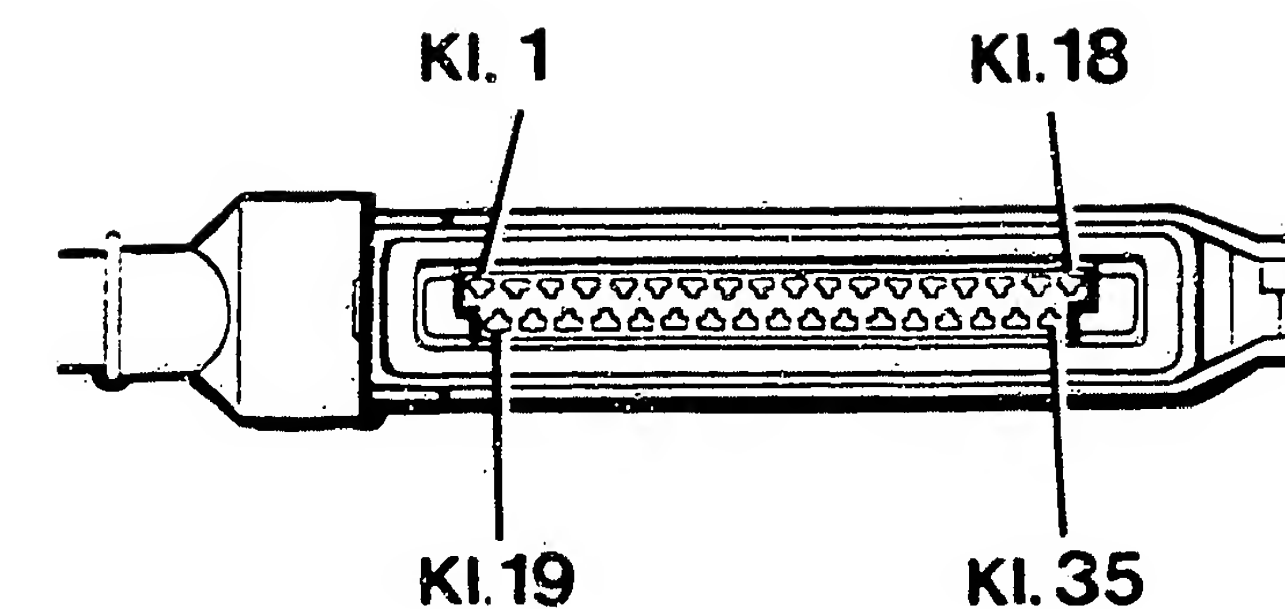
Use ohmmeter to test following leads
for continuity.

Set value: approx. 0 Ω

From control-unit plug term. 14
to A/C compressor switch

From A/C compressor switch to
ignition and starting switch
term. 15.

If leads are O.K., renew A/C
compressor switch.

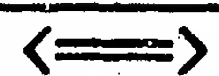


227/925

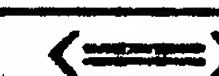
Renew control unit.

Return to switching-input-diagnosis
test table B19

G07



G08



SWITCHING-INPUT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (6)

SWITCHING-INPUT DIAGNOSIS - DRIVE SWITCH (if provided)

Detach control-unit plug.

Connect ohmmeter with test prods
to control-unit plug term. 30 and
term. 5.

Switch on drive switch.

Set value: approx. 0 Ω .

Is set value attained?

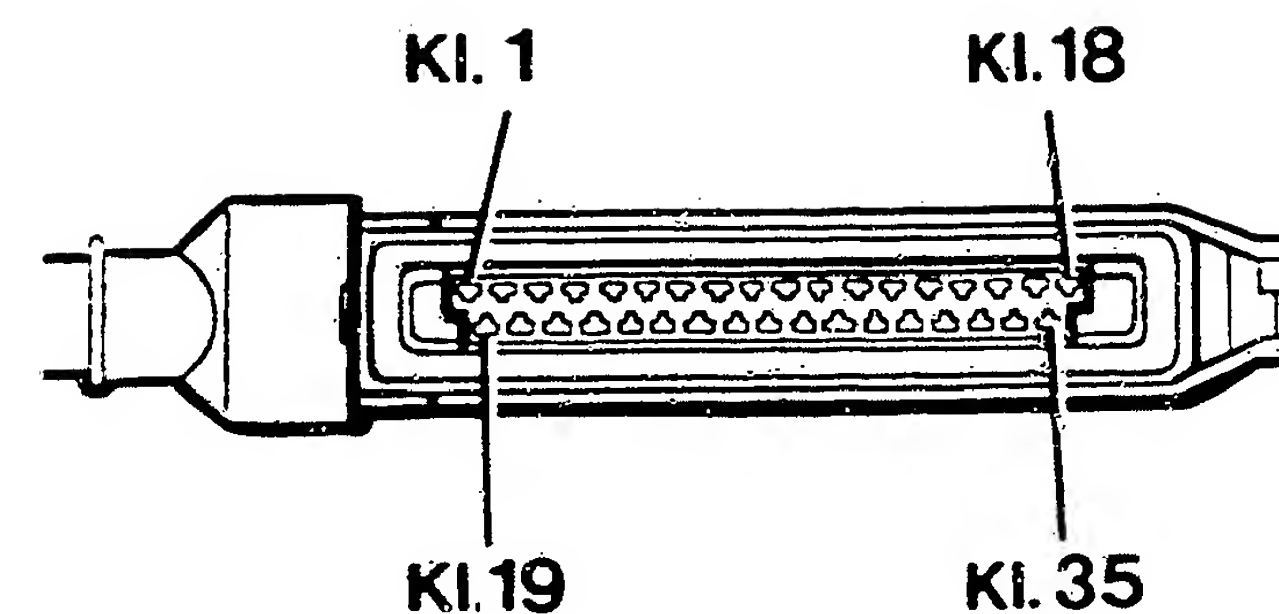
N>

Use ohmmeter to test following
leads for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 30
to drive switch.

From drive switch to vehicle
ground.

If leads are O.K., renew drive
switch.



227'925

Renew control unit.

Return to switching-input-diagnosis
test table B19

G09

<==>

G10

<==

FINAL-CONTROLLING-ELEMENT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (1)

ACTUATOR DIAGNOSIS - SOLENOID-OPERATED INJECTION VALVES

Detach plug at solenoid-operated injection valves.

Connect ohmmeter to solenoid-operated injection valve.
Perform test on all injection valves.

Set value: see brief instructions

Is set value attained?

N>

Renew respective solenoid-operated injection valve.

Removal:

Detach connector.

Pull out retaining clip.

Remove injection valve.

Caution!

Catch fuel as it emerges; it must not be allowed to get on to hot parts of engine.

Fitting:

Only oil O-rings slightly (engine oil HD 30).

Attach injection valve to fuel distributor.

Insert retaining clip into groove and engage it.

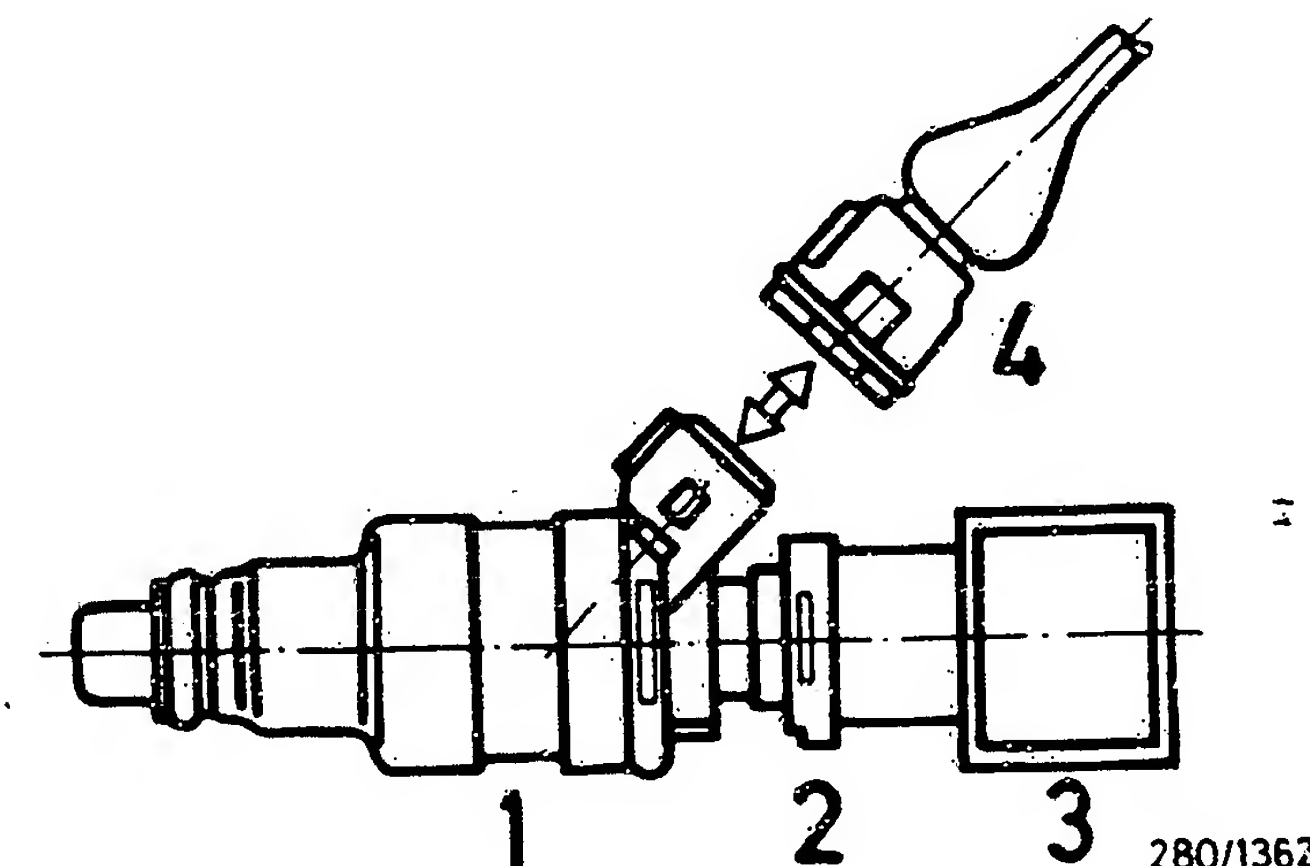
Test for fuel leaks.

Attach connector.

Install complete fuel distributor. In doing so, press all injection valves simultaneously into intake-manifold guide.

Caution!

Never damage O-rings or valve needle. Ensure that there are no intake-manifold leaks.



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

280/1362

Continued on next picture page

ACTUATOR DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (1) (CONTINUED 1)

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

Set value: approx. 0 Ω

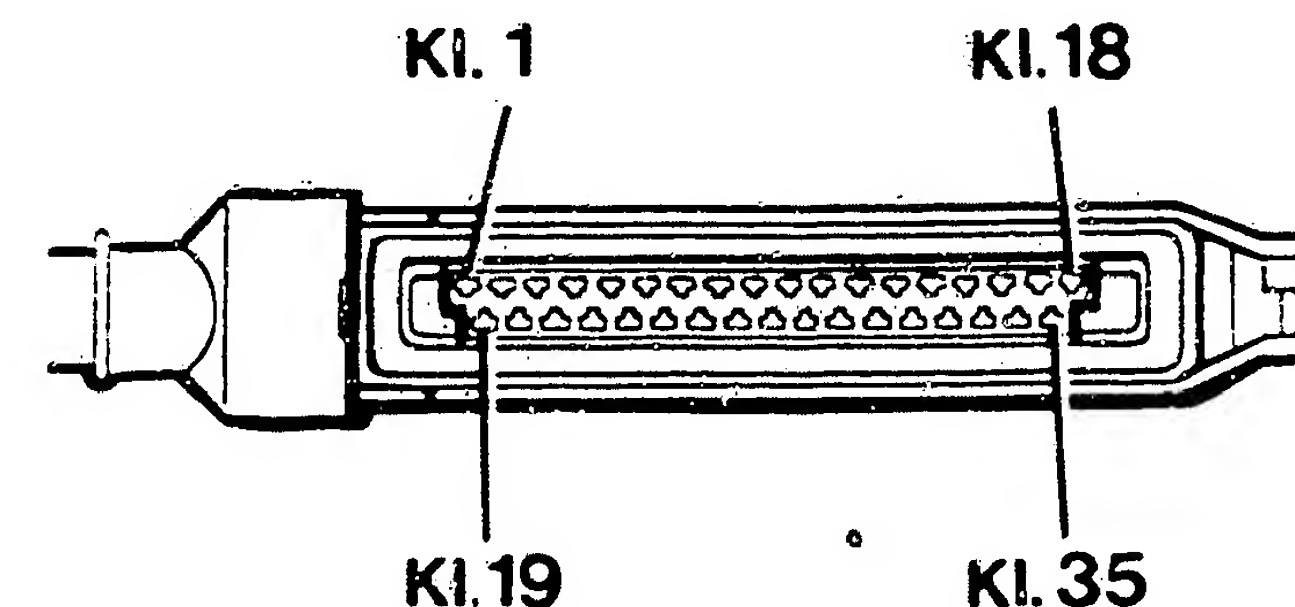
From control-unit plug term. 18 to connector of injection valve.

From pump relay term. 87 to connector of injection valve.

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/925

Detach connectors of solenoid-operated injection valves.

Switch on ignition

Measure voltage at connector term. 2 with respect to vehicle ground.

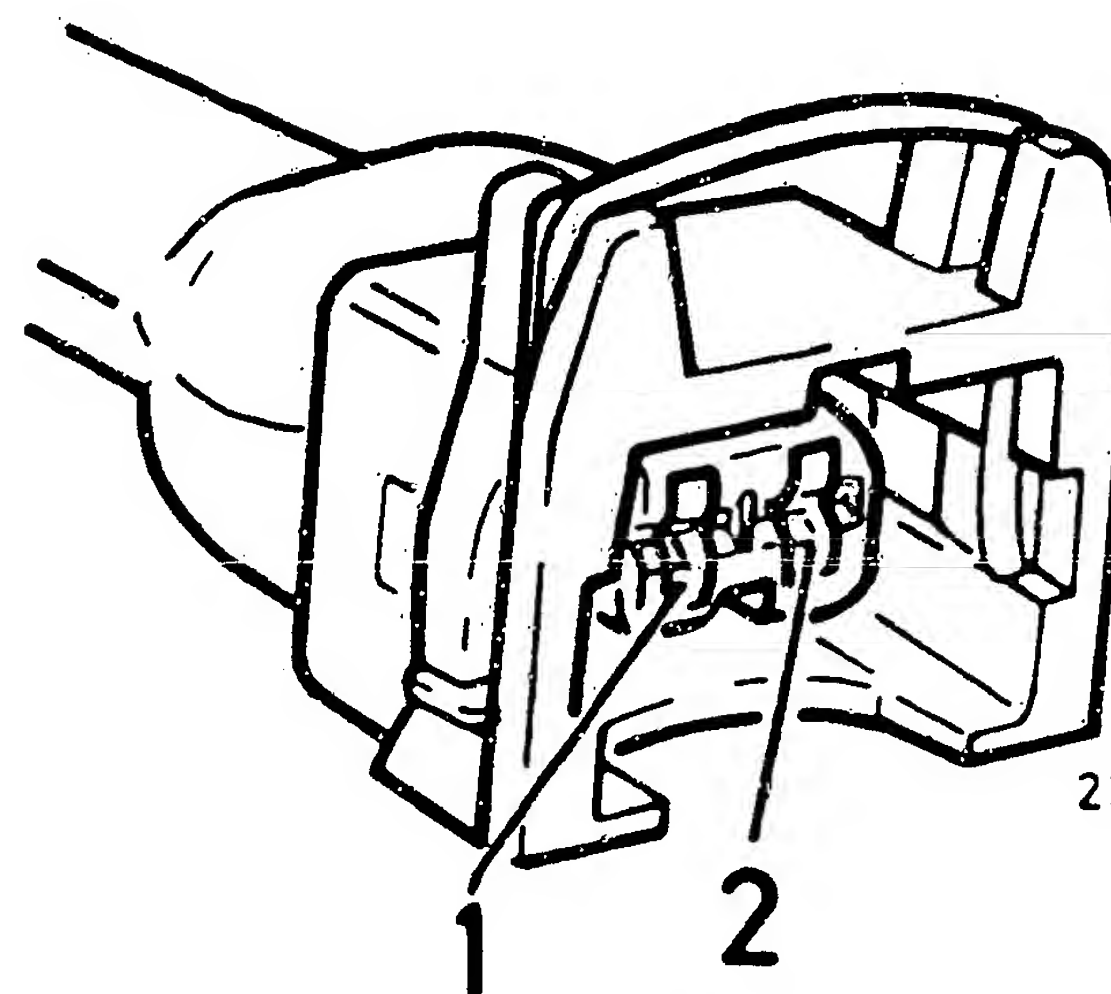
Perform test on all connectors.

Set value: 8...15 V

Is set value attained?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



227/1036

Renew control unit.

Return to final-controlling-element diagnosis - test table (B21)

G13

<=>

G14

<=>

FINAL-CONTROLLING-ELEMENT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (2)

ACTUATOR DIAGNOSIS- IDLE ACTUATOR

Detach plug from idle actuator.

Connect ohmmeter to idle actuator.

Set value: see brief instructions

Is set value attained?

Replace idle actuator.

N>

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

Set value: approx. 0 Ω

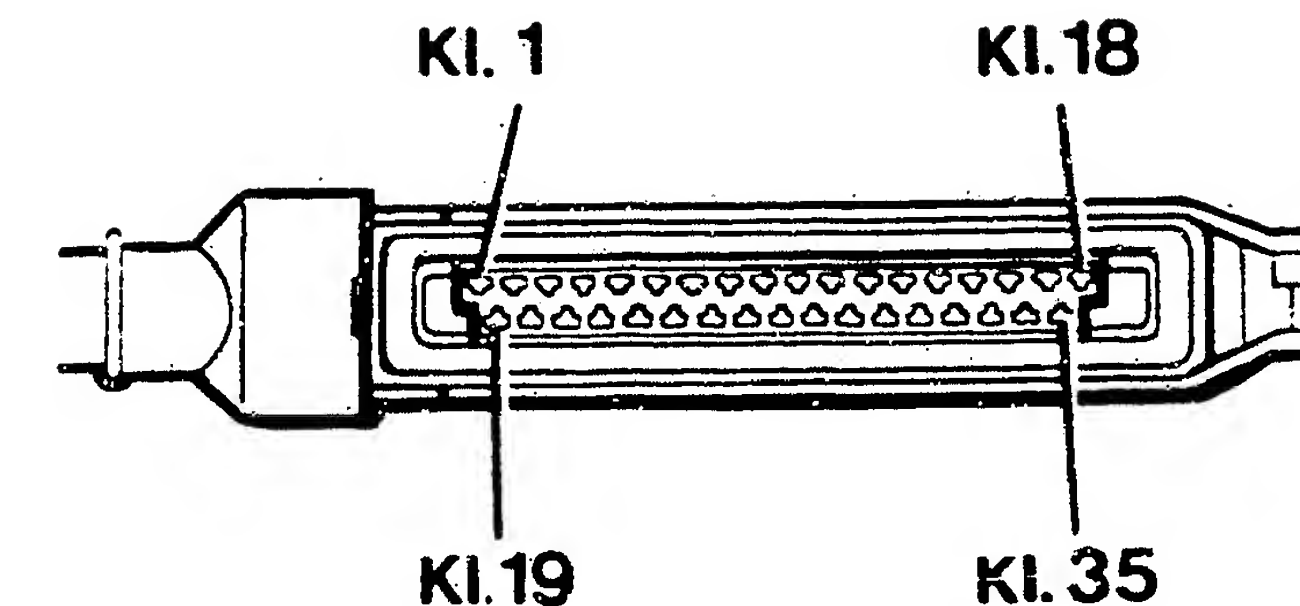
From control-unit plug term. 33 to idle actuator.

From pump relay term. 87 to idle actuator.

Is set value attained?

Eliminate contact resistances, open circuits and short circuits in leads.

N>



227 925

Continued on next picture page

G15

<=>

G16

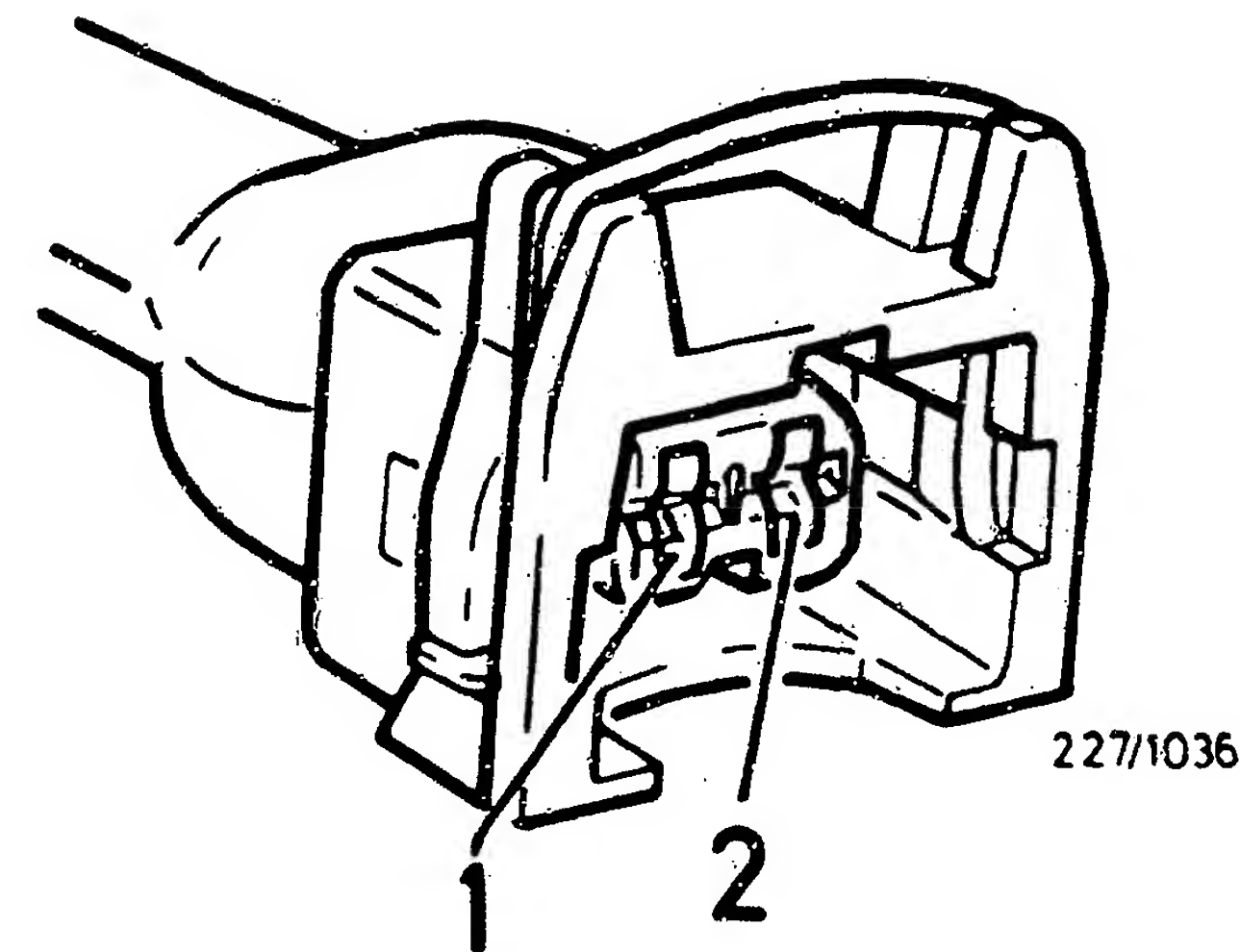
<=>

ACTUATOR DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (2) (CONTINUED 1)

Detach connector at idle actuator.
Switch on ignition
Connect voltmeter with test prod to connector term. 1 (+) and vehicle ground.
Set value: 8...15 V
Is set value attained?

N>

Eliminate contact resistances,
open circuits and short circuits
in leads.



Renew control unit.

Return to final-controlling-element
diagnosis - test table (B21)

FINAL-CONTROLLING-ELEMENT DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (3)

ACTUATOR DIAGNOSIS - TANK VENTILATION VALVE

Detach plug from tank ventilation valve.

Connect ohmmeter to tank ventilation valve.

Set value: see brief instructions

Is set value attained?

Renew defective tank ventilation valve.

Detach control-unit plug.

Use ohmmeter to test following leads for continuity.

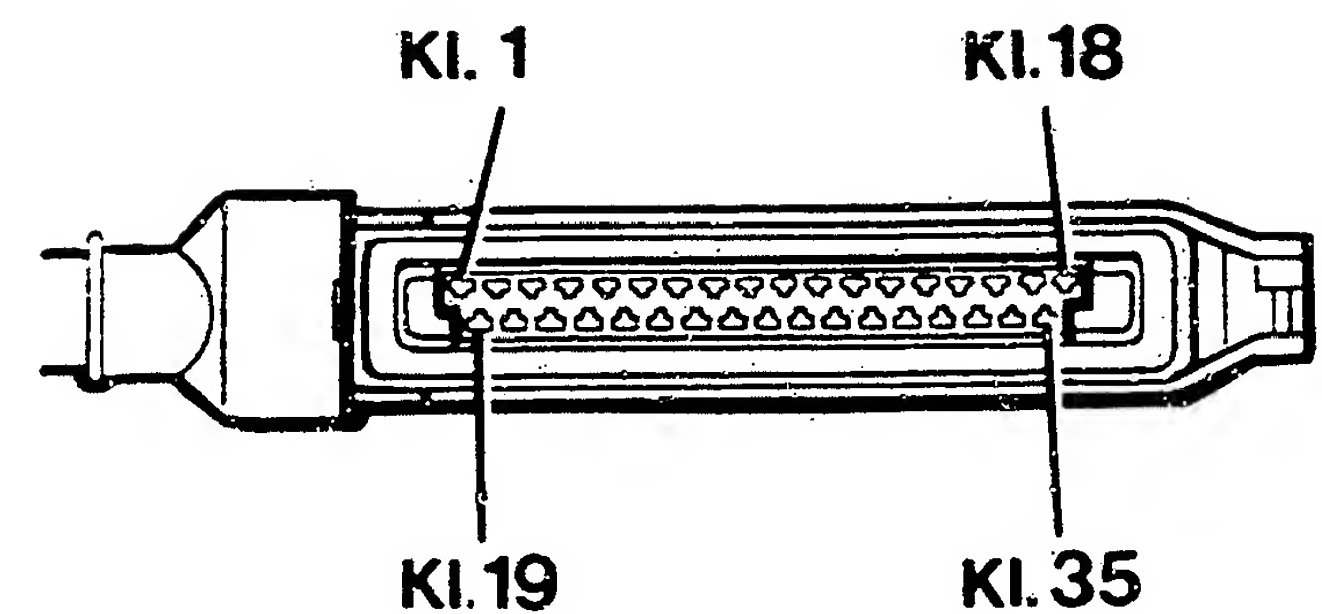
Set value: approx. 0 Ω

From control-unit plug term. 27 to tank ventilation valve.

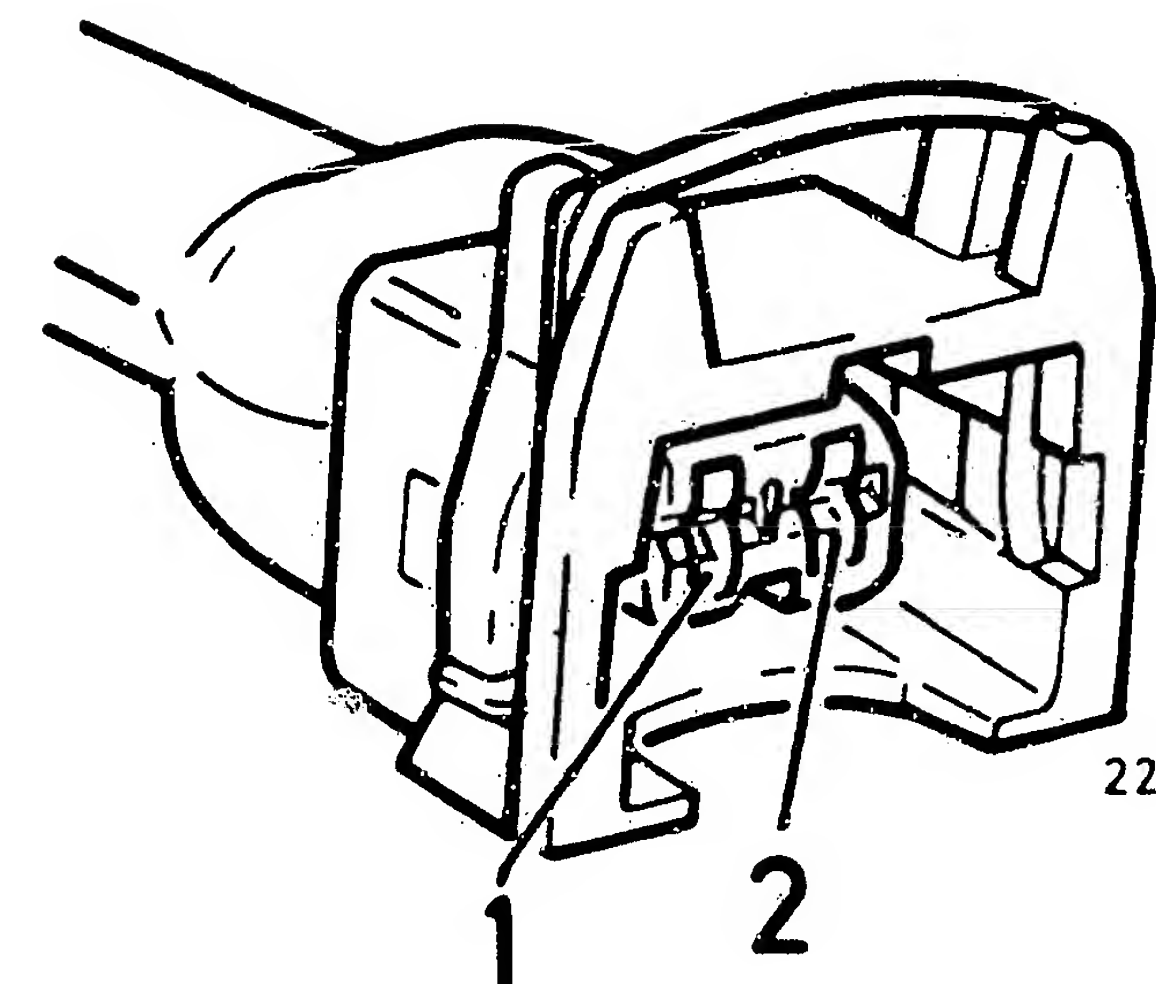
From pump relay term. 87 to tank ventilation valve.

Is set value attained?

Eliminate contact resistances, open circuits and short circuits in leads.



227/925



227/1036

Continued on next picture page

ACTUATOR DIAGNOSIS - TROUBLE-SHOOTING PROGRAM (3) (CONTINUED 1)

Detach connector at tank ventilation valve.

Start engine.

Connect voltmeter with test prod to connector term. 2 (+) of tank ventilation valve and vehicle ground.

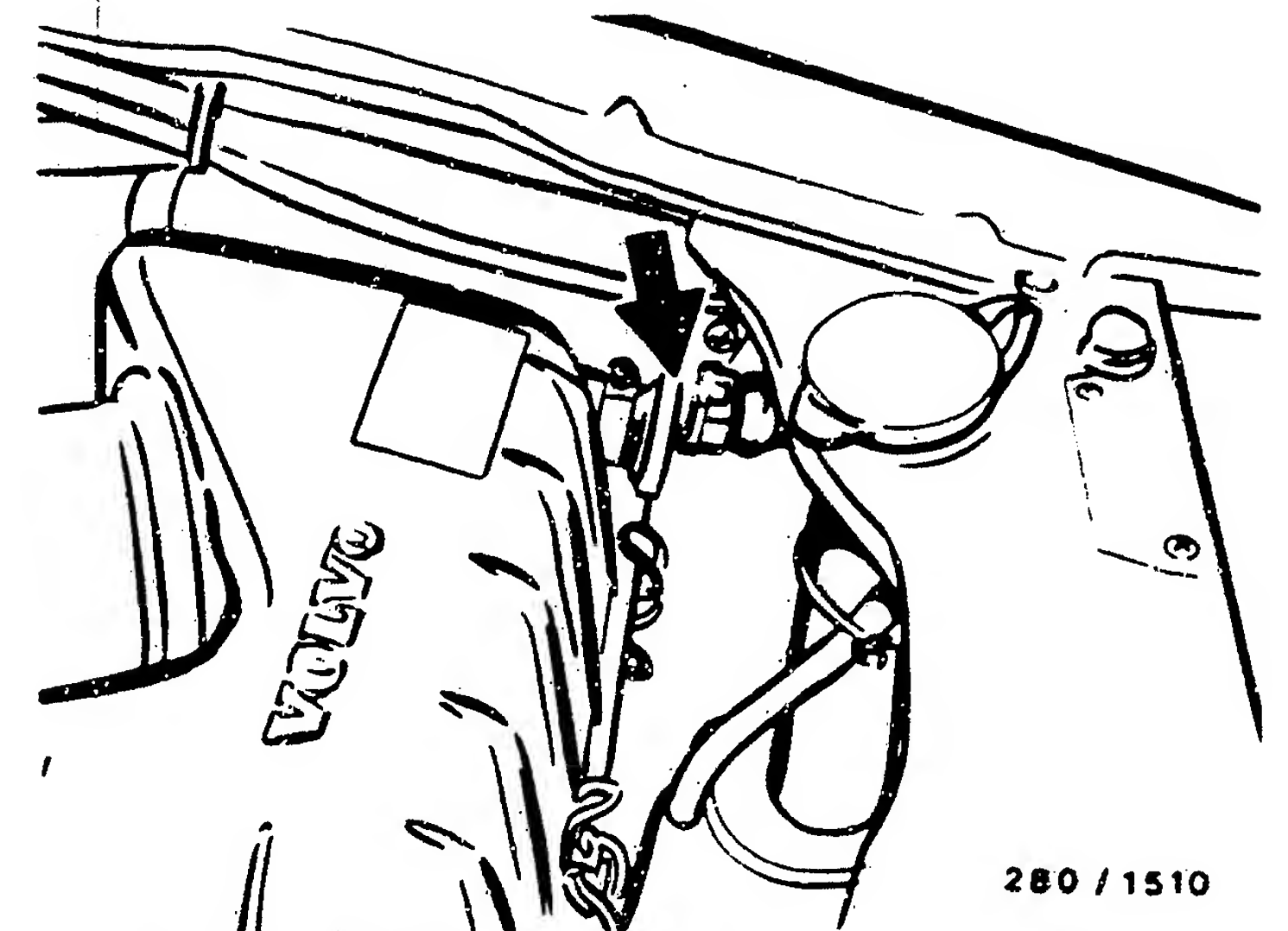
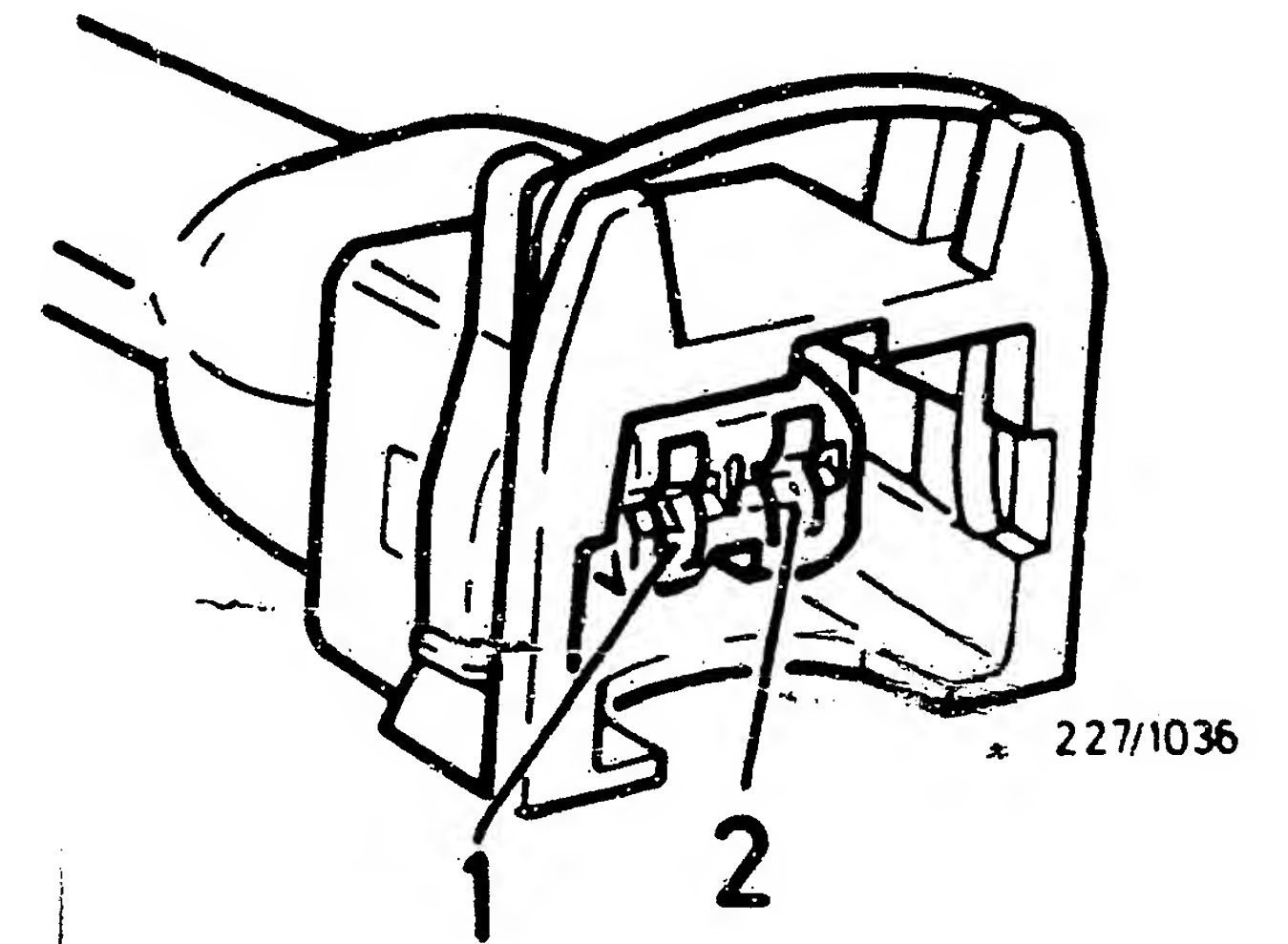
Set value: 8...15 V

Is set value attained?

N> Eliminate contact resistances, open circuits and short circuits in leads.

Y
Renew control unit.

Y
Return to final-controlling-element diagnosis - test table (B21)



TROUBLE-SHOOTING PROGRAM (1)

Test voltage supply at control unit.

Switch off ignition, detach control-unit plug.
Connect voltmeter to term. 35(+) and term. 5(-).

Switch on ignition.

SET VALUE: battery voltage

Is set value attained?

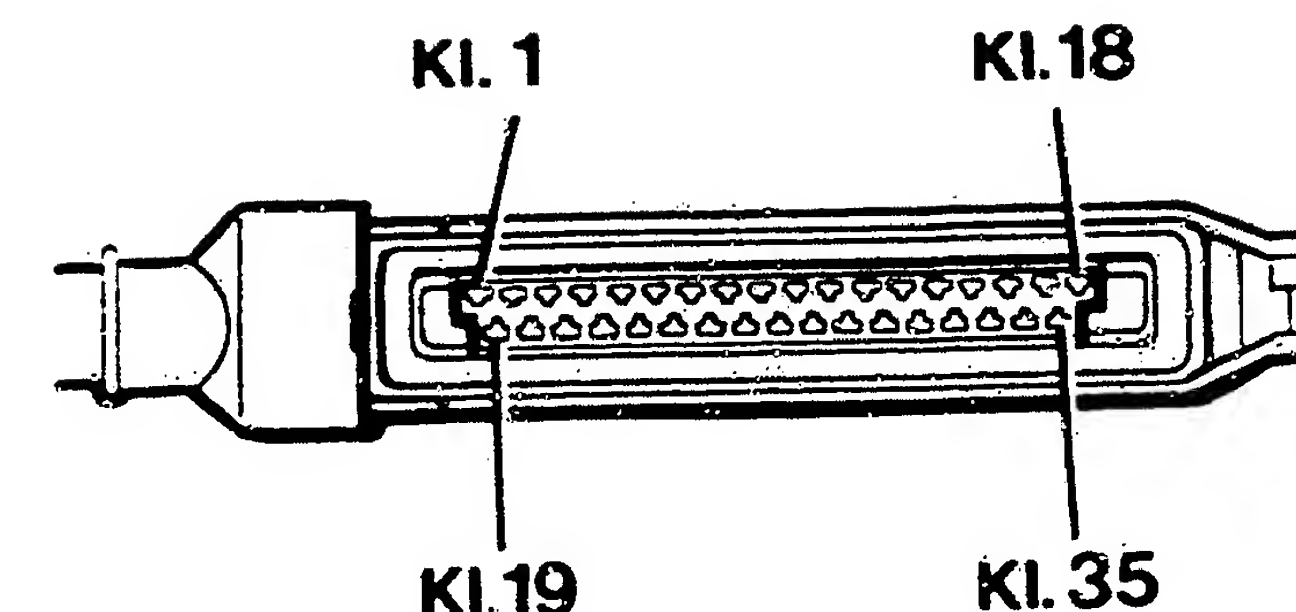
N>

Switch off ignition and detach control-unit plug.

Use ohmmeter to test following lead for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 35 to ignition and starting switch term. 15.

From control-unit plug term. 5 to vehicle ground.



227/925

Switch off ignition, detach control-unit plug.
Connect voltmeter to term. 4 (+) and term. 5 (-).

Set value: battery voltage

Is set value attained?

N>

Switch off ignition and detach control-unit plug.

Use ohmmeter to test following lead for continuity.
Set value: approx. 0 Ω

From control-unit plug term. 4 to battery term. 30 (+).

Return to trouble-shooting chart 803

G23

G24

TROUBLE-SHOOTING PROGRAM (2)

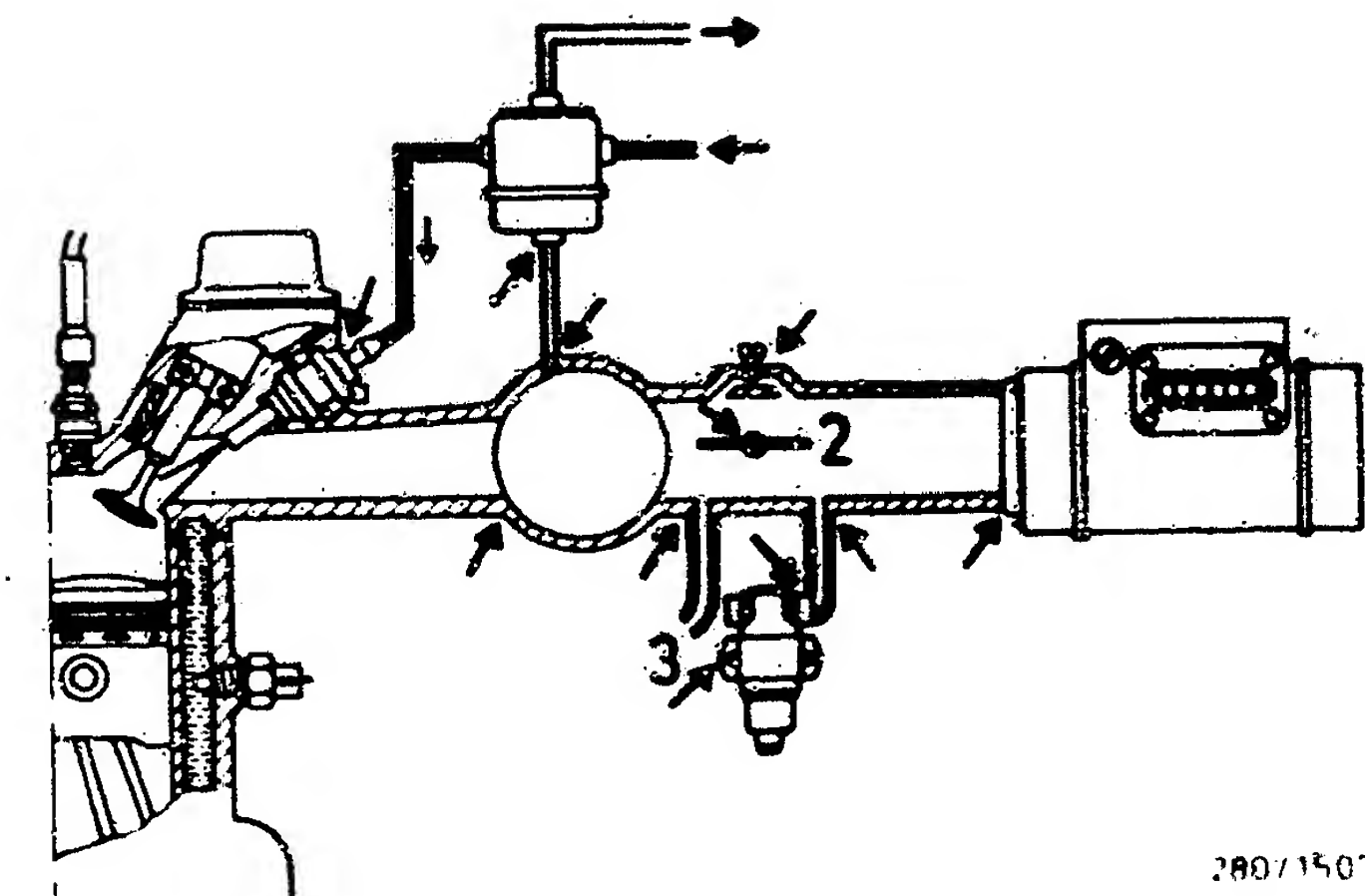
Check air-intake system

Are all hoses correctly connected, not kinked or damaged?
Is oil dipstick pressed all the way in? Is lid seal on oil filler neck O.K.?

Are all hoses O.K.?

Replace hoses if necessary.
Re-tighten hose binders.

Push in oil dipstick firmly.
Replace lid seal on oil filler neck.



280/1507

1 = Sealing
2 = Open throttle valve fully
3 = Blow in air
Small arrows = Possible leaks

Leak test

Seal tail pipe.
Unscrew air-mass meter from air-filter housing and seal air-mass-meter duct.
Detach hose downstream of idle actuator and seal idle-actuator connection.
Fully open throttle valve.

Use compressed-air gun to blow air (0.3 bar gauge pressure) into intake manifold.
Spray or brush over all seals with leakage detector spray or soapy water.

Are all points leakproof?

Bubbling or foaming indicates a leak.

Eliminate leaks by new seals or by re-tightening the hose binders.

Leaks may also occur at the following points:
Throttle-valve mounting, intake-manifold gasket as well as auxiliaries (e.g. brake booster) that work on intake-manifold pressure.

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (3)

Check solenoid-operated injection valves with engine running.

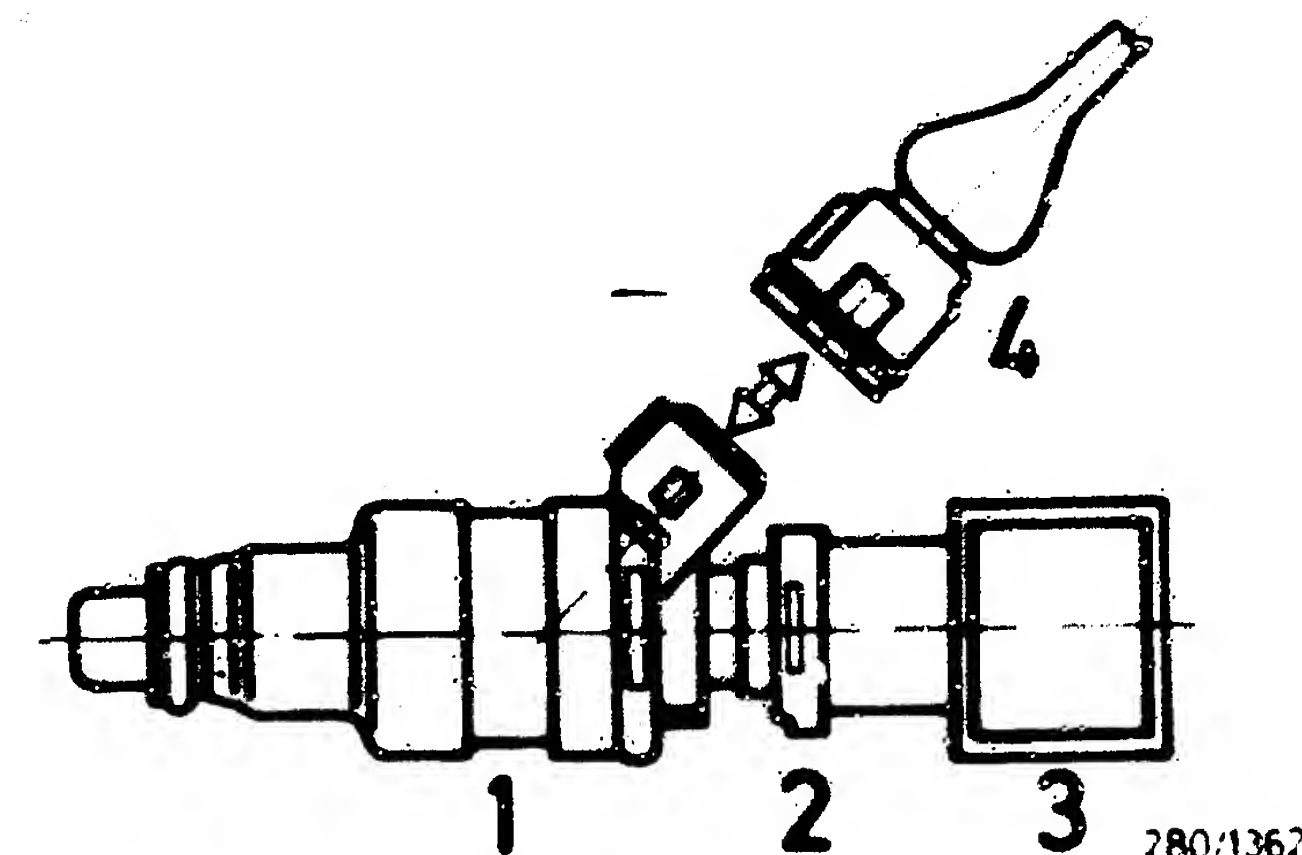
With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?

No drop in engine speed =>
Replace injection valve in question.



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

Return to trouble-shooting chart 803

TROUBLE-SHOOTING PROGRAM (4)

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator.
Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.
Disconnect pump relay.
Connect jumper into connection base between term. 87 and term. 30.
The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery
SET VALUE: See brief instructions

Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Return to trouble-shooting chart B03

*Fuel filter very dirty
→ replace.

*Fuel delivery line or pressure damper (if applicable) clogged → replace.

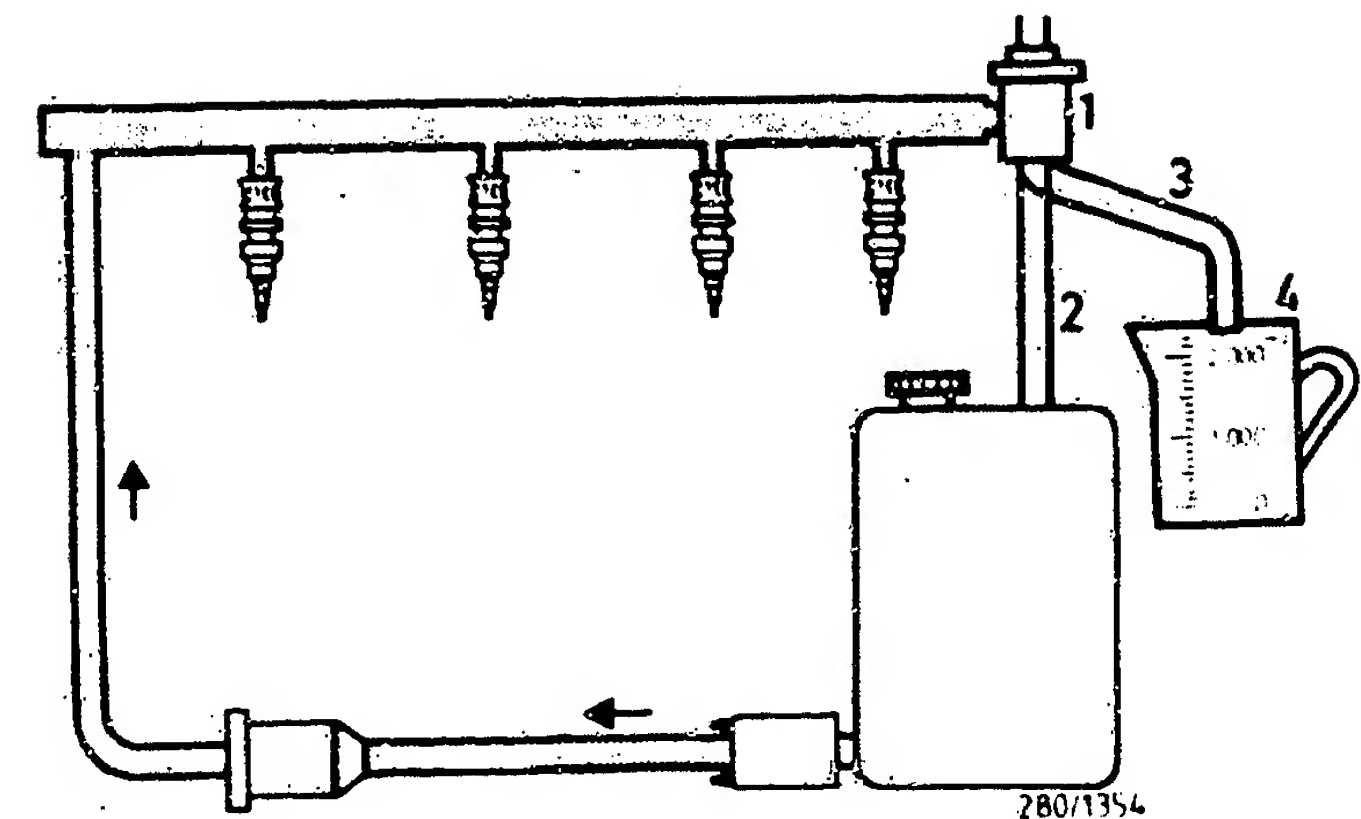
*Voltage at electric fuel pump, with engine running, min. 12 V. If not, clean contacts, eliminate poor ground connection, replace leads.

*Check pre-supply pump (if applicable). Measuring point: line between the pumps. Fuel delivery must be at least 10% greater than that of the electric fuel pump. If not → replace pre-supply pump.

*If fuel-pump delivery too low → replace electric fuel pump. Clean joints before loosening so that no dirt gets into the fuel system. In-tank electric fuel pumps are accessible via a closure on the tank.

*If electric fuel pump loud (vapor locks) intake line constricted or kinked → replace.
Strainer in tank clogged → replace.
Corrosion in tank → clean/replace.

*Pressure regulator defective - check.
See next coordinate:

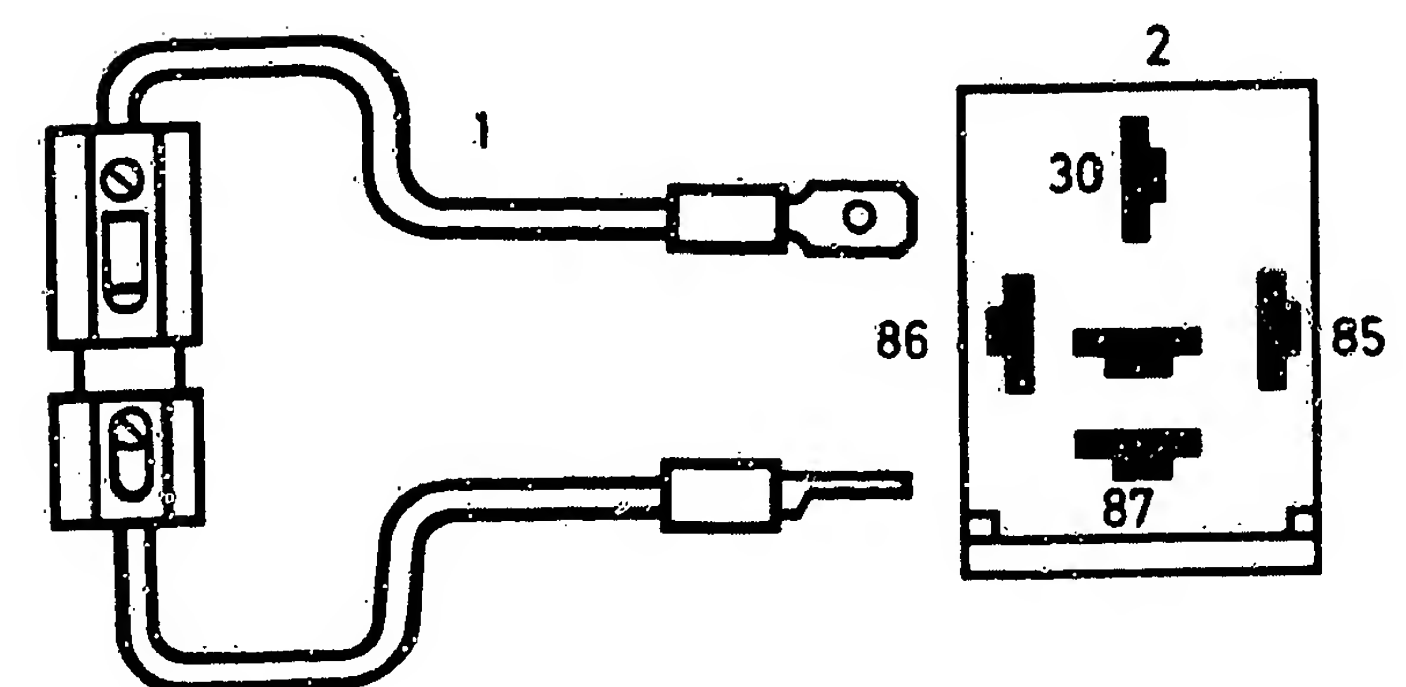


Pressureless

Fuel pressure

1 = Pressure regulator
2 = Return
3 = Test hose
4 = Measuring glass

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base



TROUBLE-SHOOTING PROGRAM (5)

Check fuel pressure with engine stopped.

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

CAUTION!

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5). Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

N>

Set value not reached:

*Slowly pinch off fuel return line. Caution! Do not allow pressure to exceed 6 bar. Renew pressure regulator if pressure exceeds 5 bar. Use new O-rings in the case of O-ring sealing technique. Apply a small quantity of engine oil (e.g. HD 30). If pressure does not increase sufficiently: fuel pump defective, renew.

*Fuel filter heavily contaminated, renew.

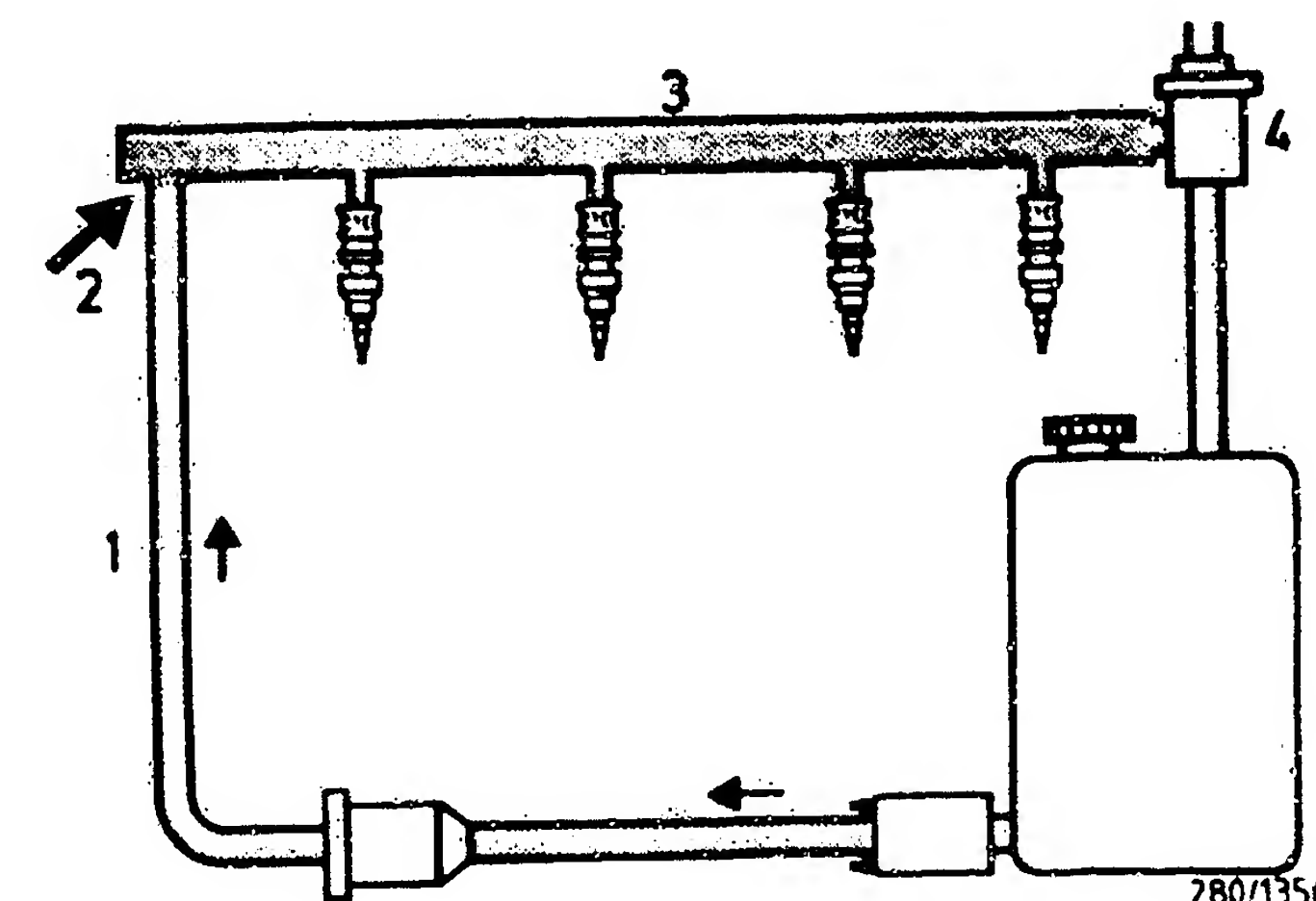
*Fuel delivery line or pressure damper (if provided) clogged, renew.

*Strainer in tank clogged. Corrosion in tank.

Set value exceeded:

Detach fuel return hose from pressure regulator. Attach test hose to pressure regulator and route it into a 1.5l measuring jug. Is set value now attained?

*If yes, fuel return line clogged or pinched off, renew.
*If not, pressure regulator defective, renew.

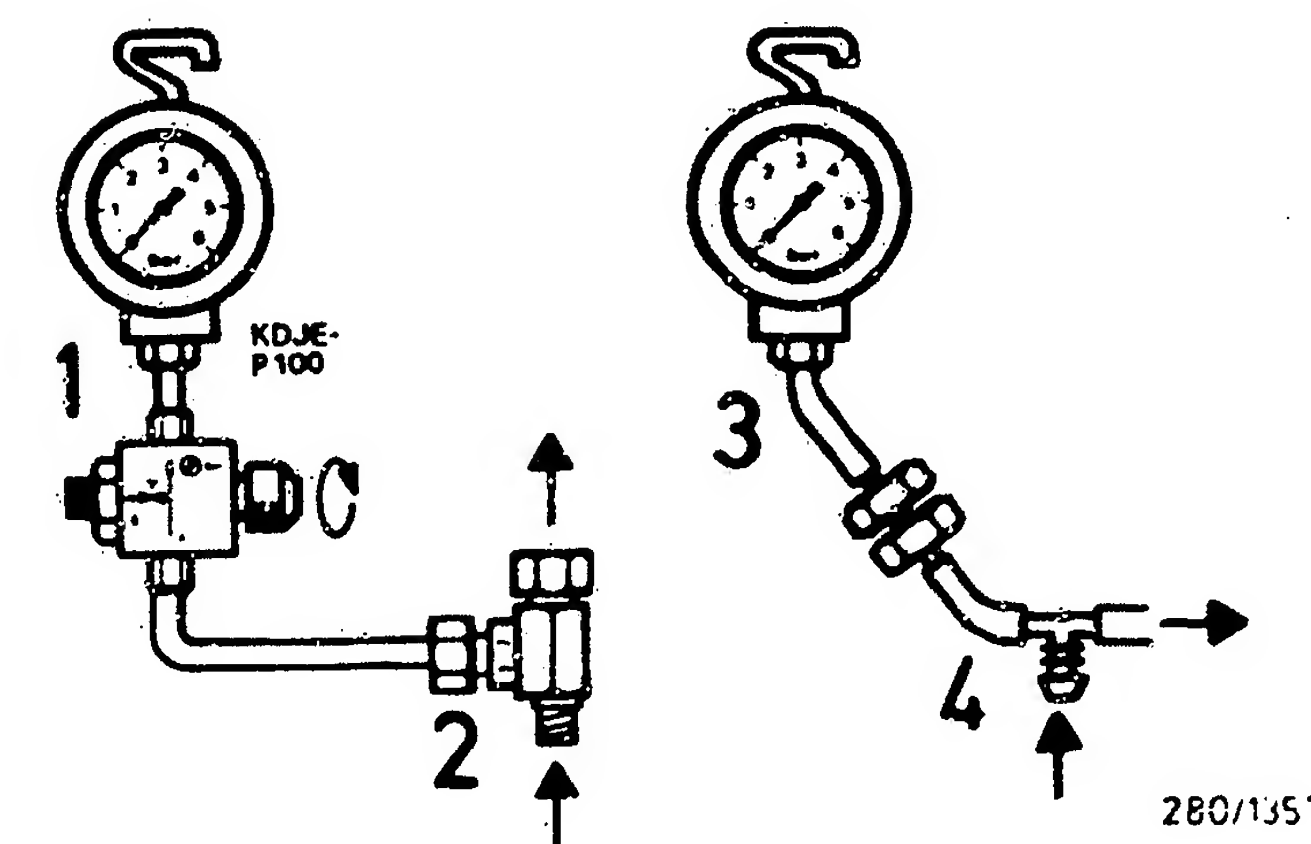


Pressureless

Fuel pressure

1 = Inlet, delivery line
2 = Measuring point
3 = Fuel-distribution pipe
4 = Pressure regulator

1 = Pressure tester
2 = Connec. part KDJE-P100/14
3 = Pressure gauge with hose line
4 = Three-way line KDJE-P100/13



Continued on next picture page

TROUBLE-SHOOTING PROGRAM (5) CONTINUED (1)

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure
SET VALUE: approx. 0.5 bar
lower than with engine stopped.

Set value obtained?

N>

*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking -> replace.
Hose line dropped off -> re-connect.

*If intake-manifold-pressure energization O.K. -> replace pressure regulator.

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure
SET VALUE: min. 1.0 bar
after 20 minutes.

Set value obtained?

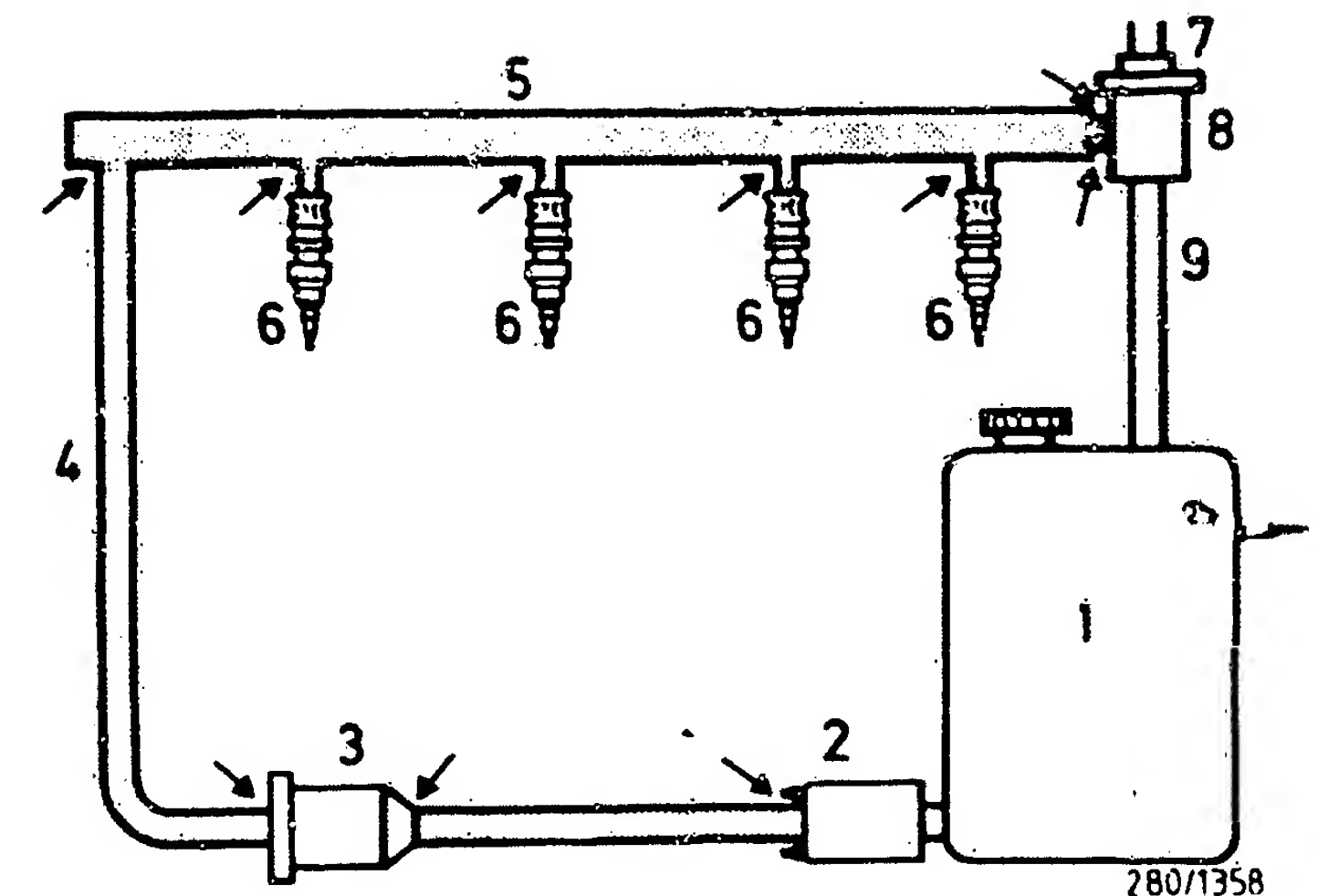
N>

*Leaking at joints between components, fuel hoses and fuel lines -> tighten hose binder or replace hose.

*Pressure regulator (diaphragm) leaking -> replace.

*Electric fuel pump (non-return valve) leaking.
With screw-type non-return valve -> replace.
With integral non-return valve -> replace electric fuel pump.

*Pressure damper or fuel filter leaking -> replace.



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks

Continued on next picture page

Continued on next picture page

*Leak in injection valve(s)
at point of connection with
fuel distributor; renew
O-ring. See text below.

*Check injection valve(s)
(needle seat) for leaks:

Remove complete fuel distributor.
Supply and return remain
connected. Simultaneously
pull all injection valves
out of intake-manifold guide.

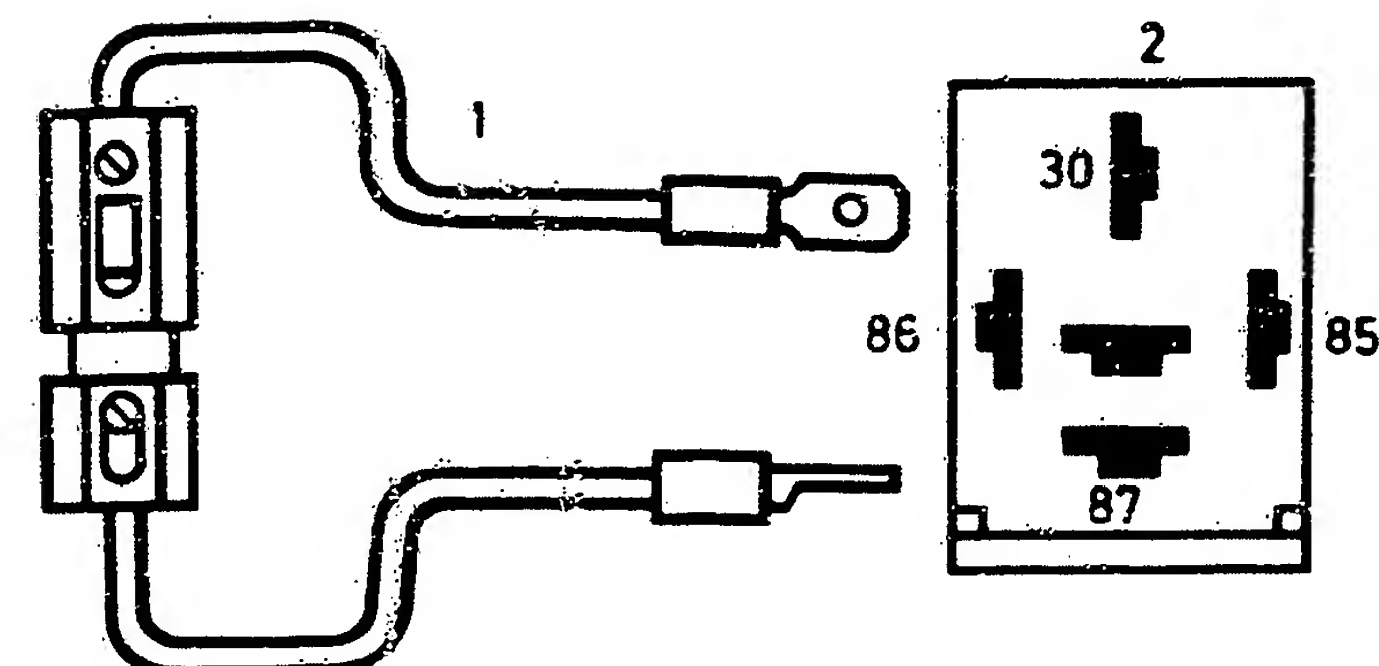
Fit jumper between term. 87
and term. 30 in connection
frame (pump relay).
Electric fuel pump must
run.

Set value:

No droplets may drip off the
injection valve within 60 s.
If they do so, renew injection
valve.

Removal:

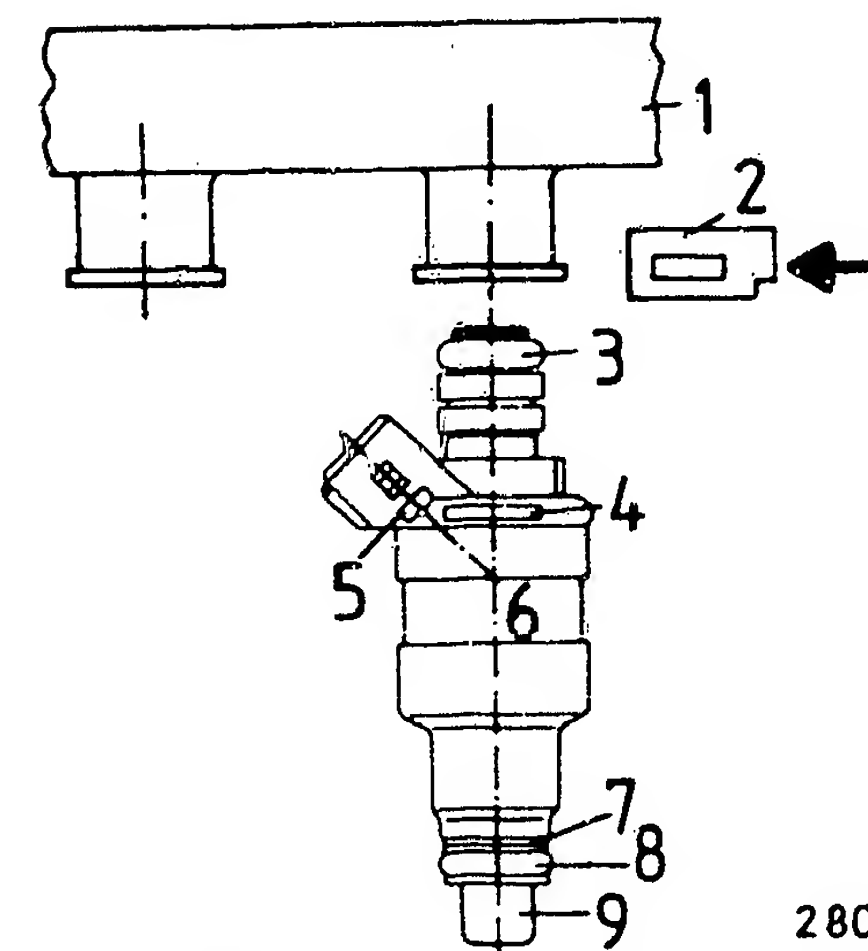
Detach connector.
Pull out retaining clip.
Remove injection valve.
Caution!
Catch any fuel which emerges.
It must not be allowed to make
contact with hot engine components.



280/1359

1 = Jumper with fuse holder
and 10 A fuse (user-
fabricated)
2 = Top view of connection
base

1 = Fuel-distribution pipe
2 = Holding clamp
3 = Upper O-ring
4 = Part number
5 = Date of manufacture
6 = Injection valve
7 = Supporting plate
8 = Lower O-ring
9 = Protective sleeve



280/1360

Continued on next picture page

Continued on next picture page

TRUBLE-SHOOTING PROGRAM (5) CONTINUED (3)

If there is no injection valve leakage (needle seat), but O-ring is defective, renew O-ring.

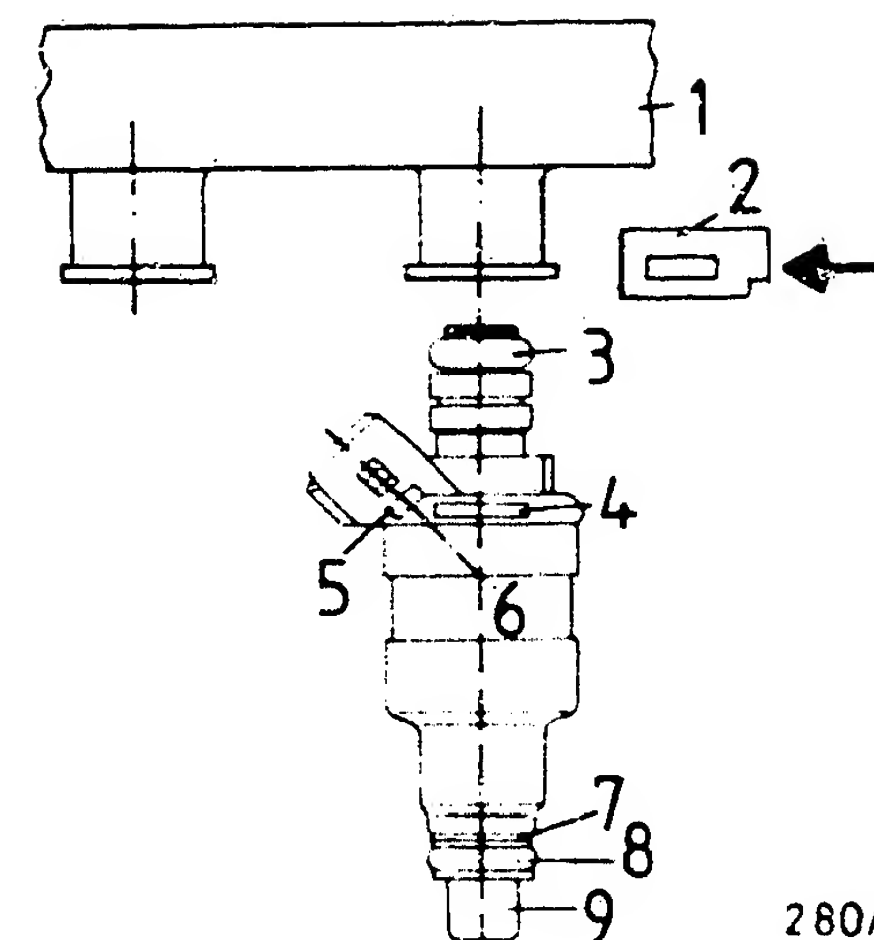
Use new parts set.
Caution! Do not damage protective sleeve and valve needle

If upper O-ring (fuel distribution pipe) is damaged, renew it.

If lower O-ring (intake manifold) is defective, cut it up.
Fit new O-ring over protective sleeve and its beading.

Fitting:
Slightly lubricate O-rings only with engine oil (e.g. HD 30).
Attach injection valve to fuel distribution pipe.
Insert retaining clip into groove and engage it.
Test for fuel leakage.
Attach connector.

Fit complete fuel distribution pipe. In doing so, simultaneously press all injection valves into intake manifold guide.
Important!
Do not damage O-rings or valve needles.
Make sure intake manifold is not leaking.



280/1360

- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = Date of manufacture
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.
Connect fuel-inlet hose to fuel-distribution pipe.
Make sure there are no leaks.

Return to trouble-shooting chart B03

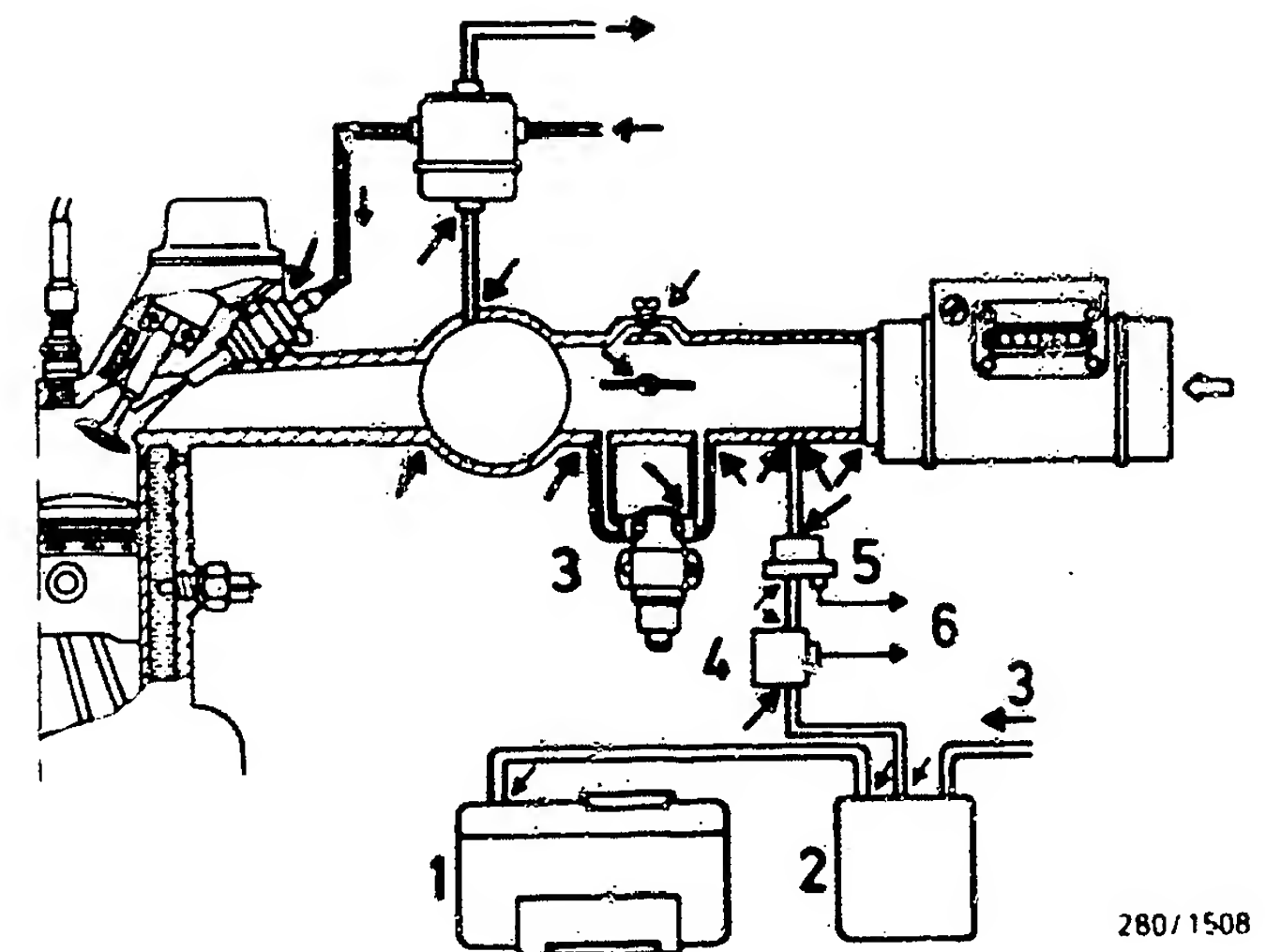
TROUBLE-SHOOTING PROGRAM (6)

Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

Replace defective hoses as necessary.
Eliminate leakages by tightening hose clamps.



280/1508

- 1 = Fuel tank
- 2 = Activated-carbon canister
- 3 = Air supply
- 4 = Solenoid-operated valve
- 5 = Tank-ventilation valve
- 6 = Electrical connections

Arrows = possible leakage points

Continued on next picture page

V
Functional test of tank ventilation valve

Test actuation signal for ACF frequency valve with oscilloscope. To do so, connect 2-pole test lead 1 684 463 093 between tank ventilation valve and its connector.

Connect Motortester (special input) to test lead:

Red pickup to one of the test-lead connections, black pickup to engine ground.

Caution: the free test-lead terminal must not come into contact with ground.

Start engine at operating temperature, part-load operation.

If connection is correct, oscilloscope must indicate pulses corresponding to the adjacent picture (top).

Set value: pulses

Pulses?

N>

Switch off engine and detach control-unit plug as well as tank-ventilation-valve plug.

- * Use ohmmeter to test lead from control unit term. 27 to plug of tank ventilation valve term. 1 for continuity.
Set value: 0 Ω

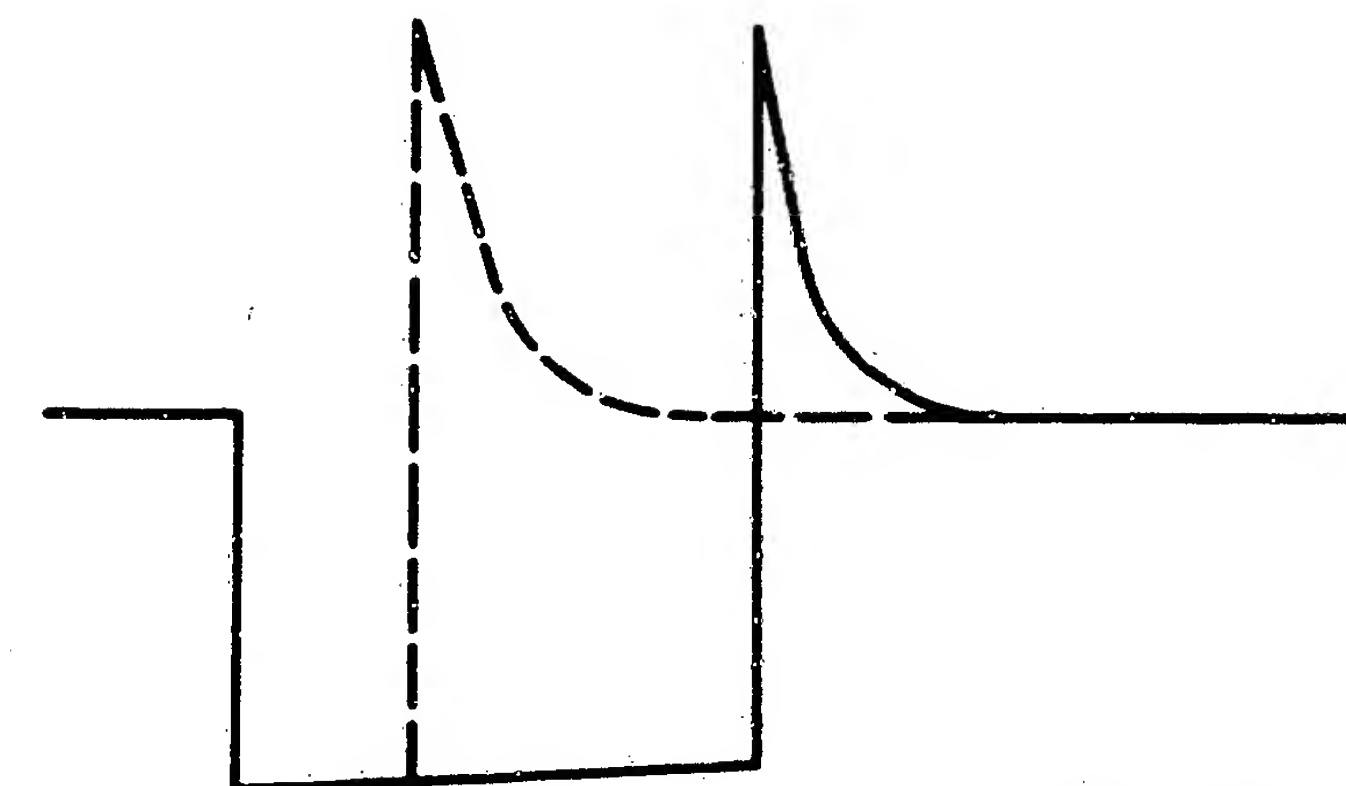
Eliminate any open-circuit.

- * Switch on ignition and use voltmeter to test voltage supply at plug of tank ventilation valve term. 2.

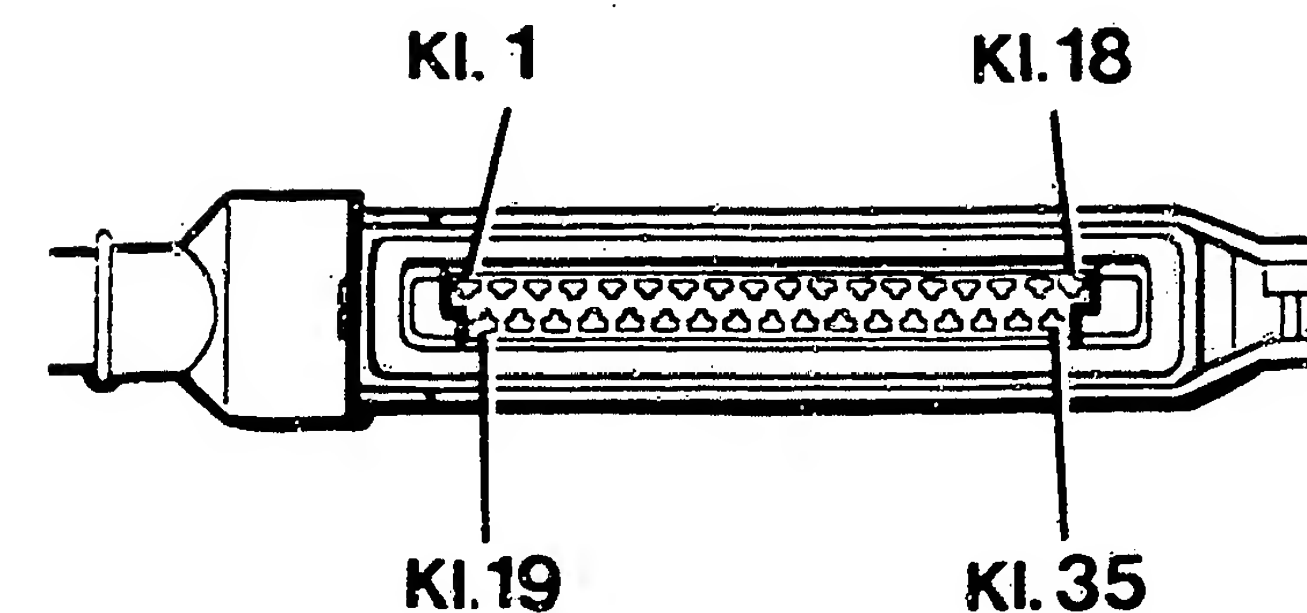
Set value: battery voltage.

Eliminate any interruption in voltage supply from ignition lock via main relay to tank ventilation valve.

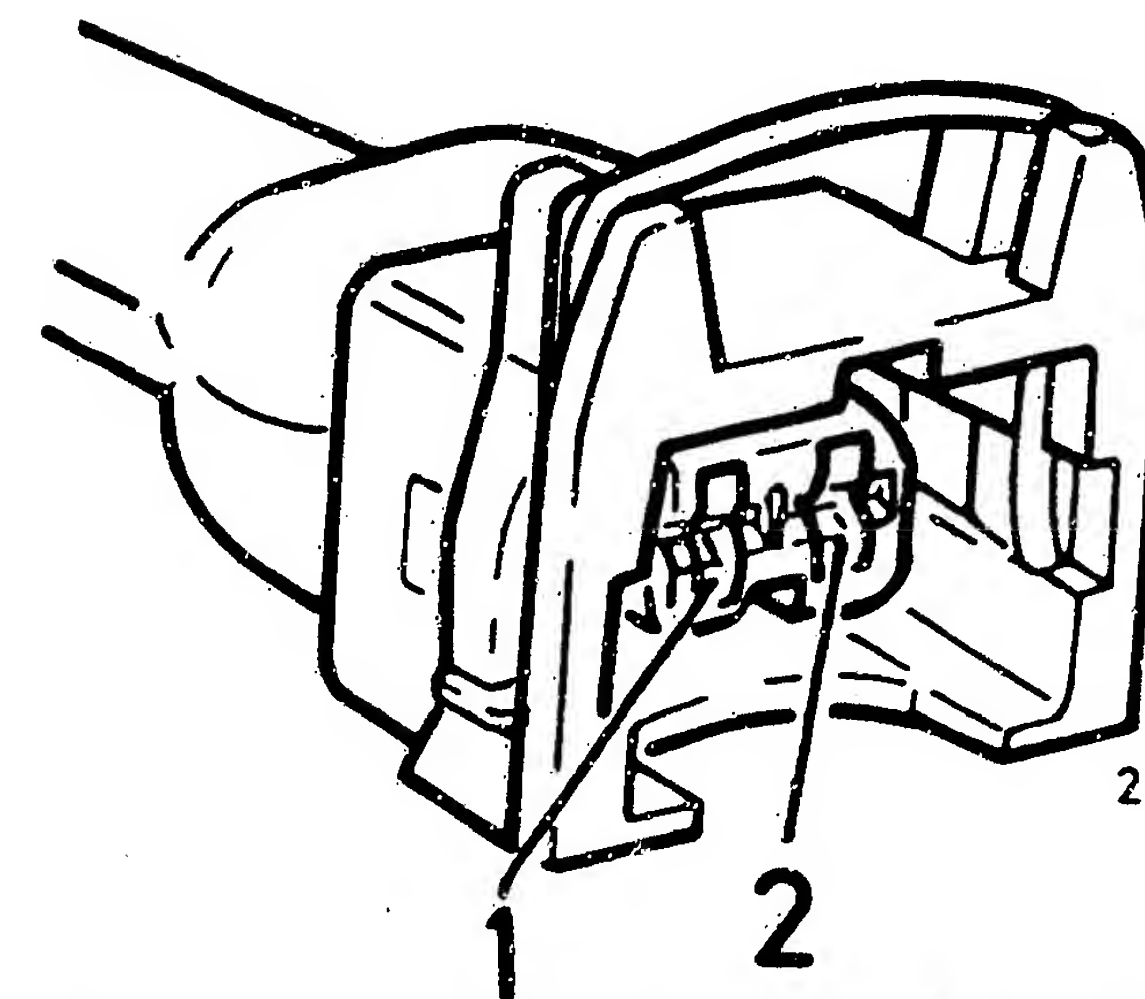
If there is no fault in lead: control unit defective.
Renew control unit.



280/1509



227/925



227/1036

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (6) CONTINUED (2)

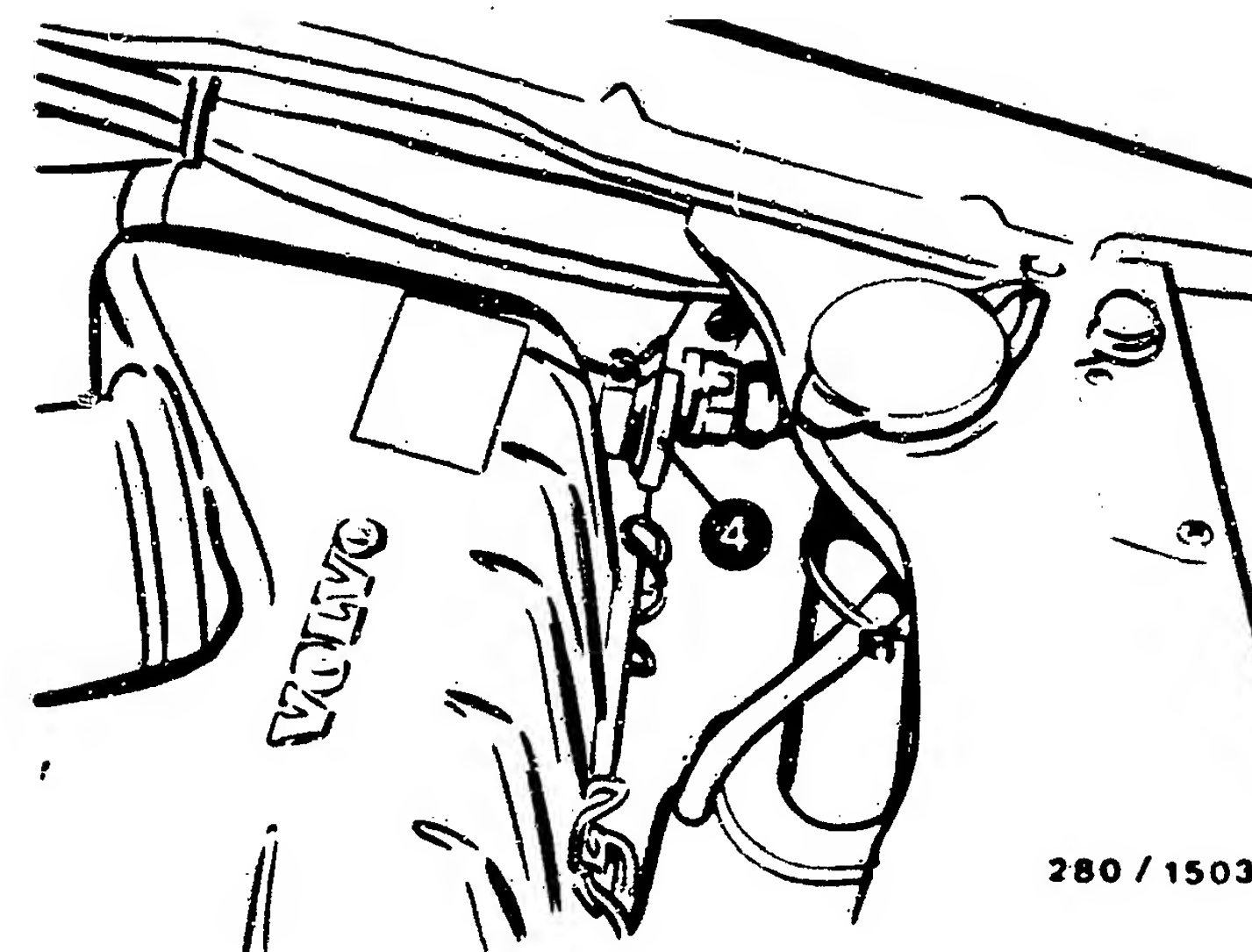
Switch off engine and detach connector at tank ventilation valve.

Use ohmmeter to measure internal resistance of valve directly at the two contacts.

Set value: see brief instructions

Is set value attained?

Internal resistance not within tolerance: renew tank ventilation valve.



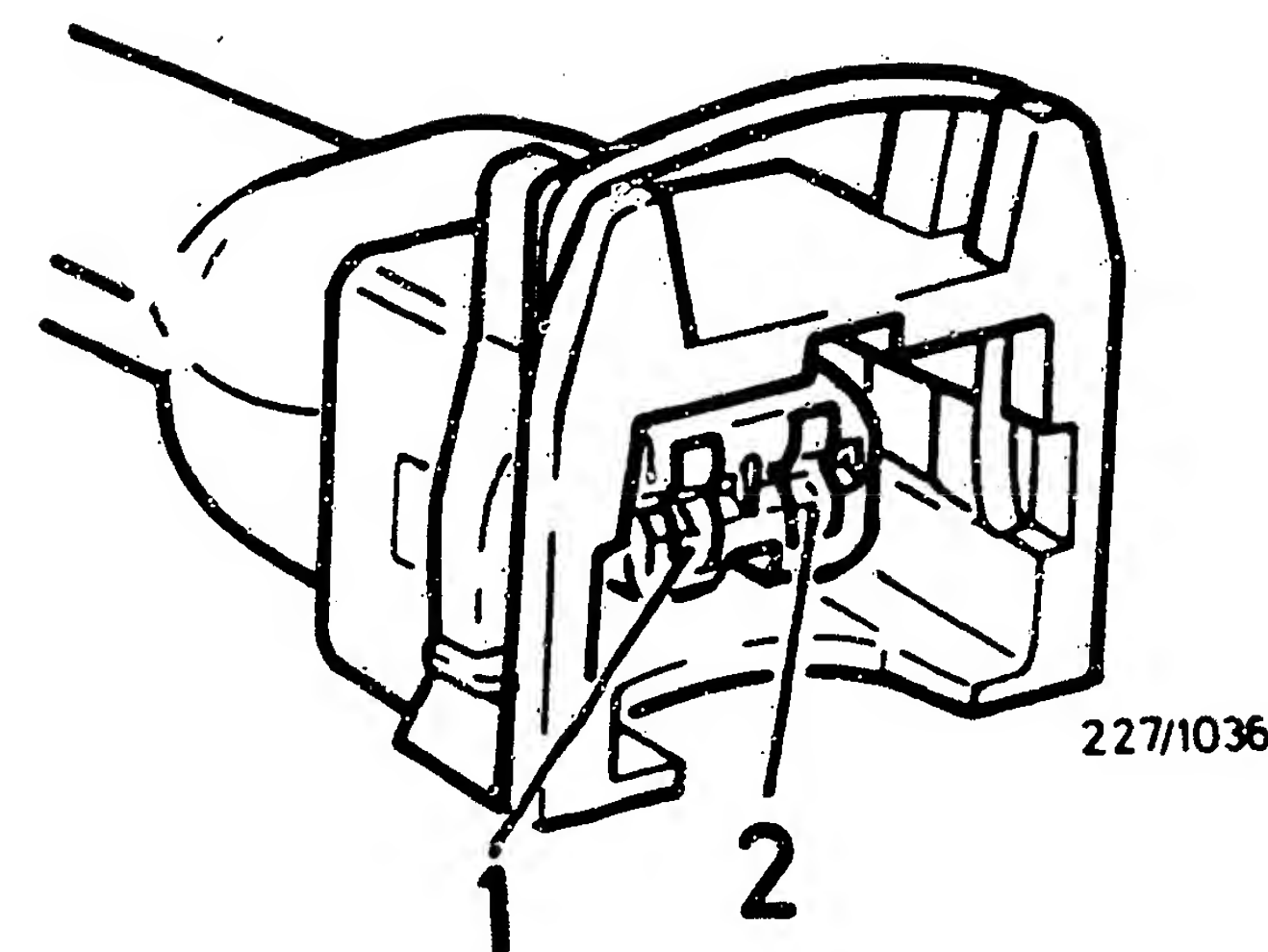
Testing mechanical switching function of tank ventilation valve:

Connect term. 1 of connector with test leads KDZS 0004 to positive terminal of battery.
Connect further test lead KDZS 0004 to second contact of valve.

Briefly connect test lead several times to engine ground. It must be possible to hear and feel the valve switching.

Does the valve switch?

Renew tank ventilation valve if it sticks or does not move freely.



Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (7)

Test start control.

Detach ignition cable term. 4 from ignition distributor cap and connect to ground with 5k Ω sleeve-type suppressor 0 356 500 001. Engine must not start.

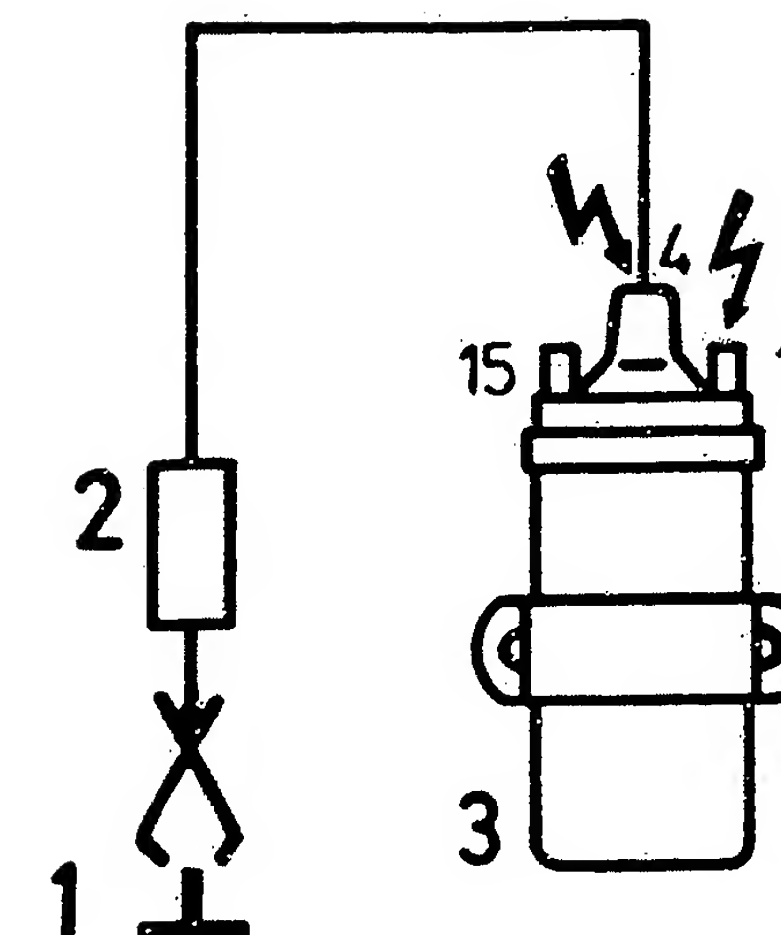
Connect 2-pole test lead 1 684 463 093 between one solenoid-operated injection valve and its connector. Connect multimeter (preferably analog version) to free measurement terminals. Measuring range approx. 10 V. Detach connector from temperature sensor (engine) and connect 10 k Ω resistor, e.g. temperature sensor 0 280 130 028 (at 15°C...30°C 10 k Ω).

MEASUREMENT:

Start engine.
Set value: voltage drops from initially greater than 1,5 V within approx. 15 s starting time to approx. 0,3 V.
Start repetition time longer than 1 minute.

Is set value attained?

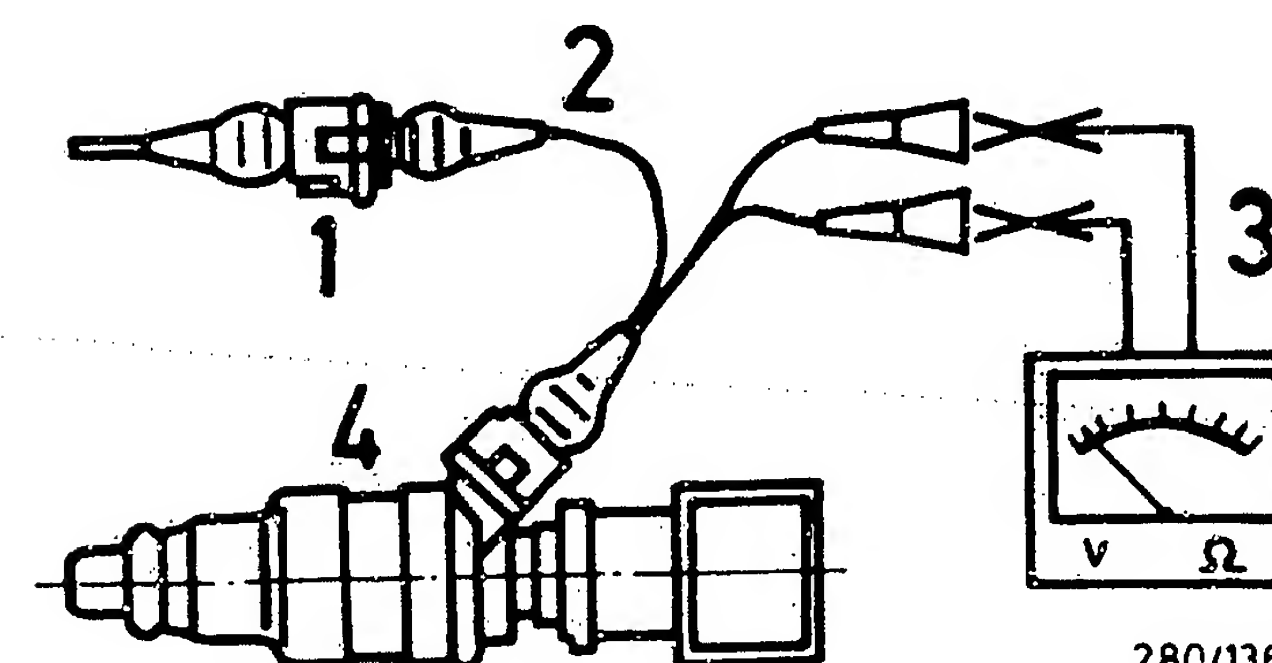
If voltage values not obtained
=> replace control unit.



280/1511

- 1 = Ground terminal
- 2 = 5 k Ω sleeve-type suppressor 0 356 500 001
- 3 = Ignition coil
- Caution! term. 1 and term. 4:
hazardous voltages 400 V - 25 kV.

- 1 = Connector from vehicle wiring harness
- 2 = Test lead 1 684 463 093
- 3 = Multimeter
- 4 = Injection valve



280/1364

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (8)

Check overrun cutoff

Connect the two-pole test lead 1 684 463 093 between a solenoid-operated injection valve and its connector. Connect motortester (special input) to test lead. Black clamp to vehicle ground. Connect red clamp to one of the two connections of the test lead.

Caution: the free connection of the test lead must not come into contact with ground.

Let engine run.

If correctly connected, injection pulses will be visible on the oscilloscope (diagram opposite).

Set value: injection pulses

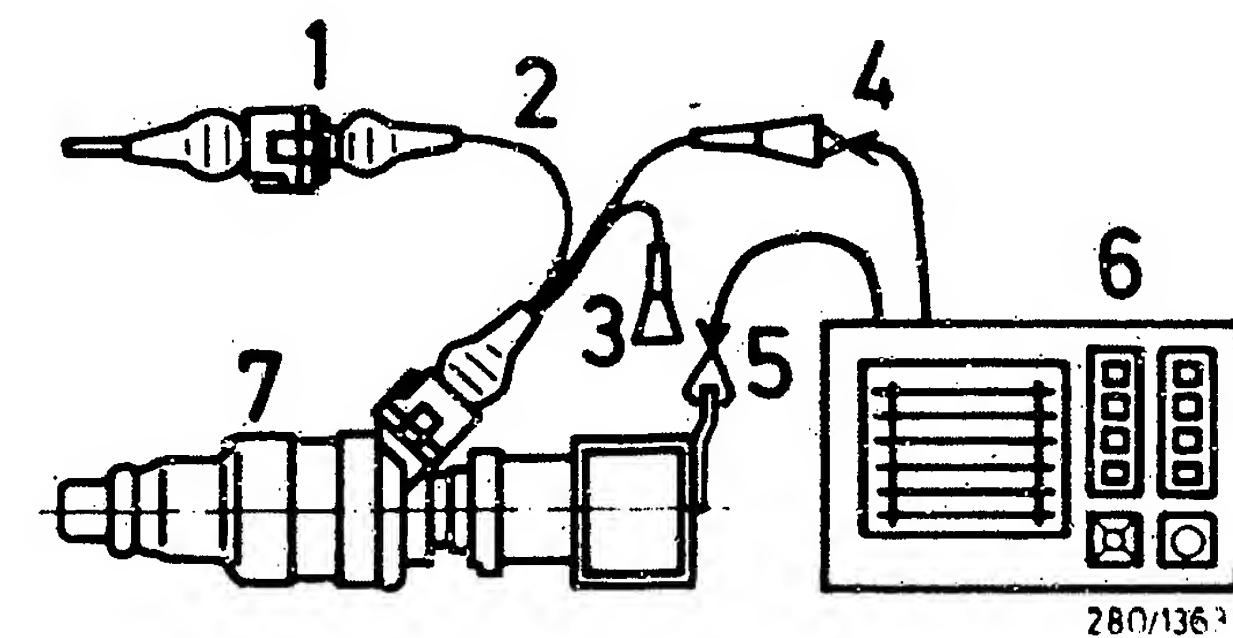
Set value obtained?

N>

Check connections.

Connect the red clamp from the motortester to the other connection of the test lead.

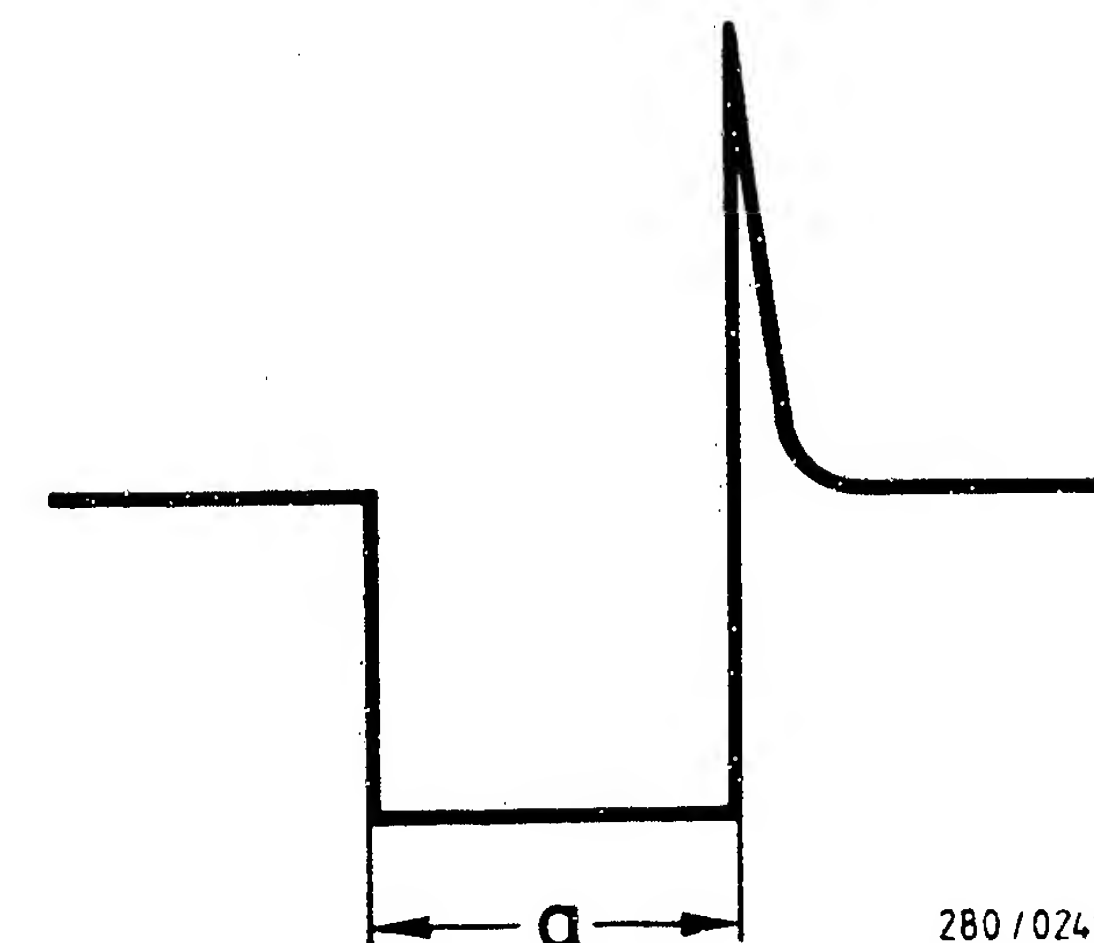
The free connection must not come into contact with ground.



- 1 = Connector
- 2 = Test lead 1 684 463 093
- 3 = Free connection
- 4 = Red clamp
- 5 = Black clamp
- 6 = Motortester
- 7 = Injection valve

Injection pulses of a switched output stage (measured at the injection valve)

a = Pulse length (dependent on engine load)



Continued on next picture page

TROUBLE-SHOOTING PROGRAM (8) CONTINUED (1)

Slowly run up engine to approx.
3000 min⁻¹,
Injection pulses must be visible
on oscilloscope.
Take foot off accelerator pedal
(idle position).
Injection pulses no longer present.

Set value:
With decreasing engine speed,
injection signals cut in again
above the idle speed.

Is set value attained?

Set value:
With decreasing engine speed,
injection signals cut in again
above the idle speed.

Is set value attained?

Is set value attained?

Slowly run up engine to approx.
3000 min⁻¹,
Injection pulses must be visible
on oscilloscope.
Take foot off accelerator pedal
(idle position).
Injection pulses no longer present.

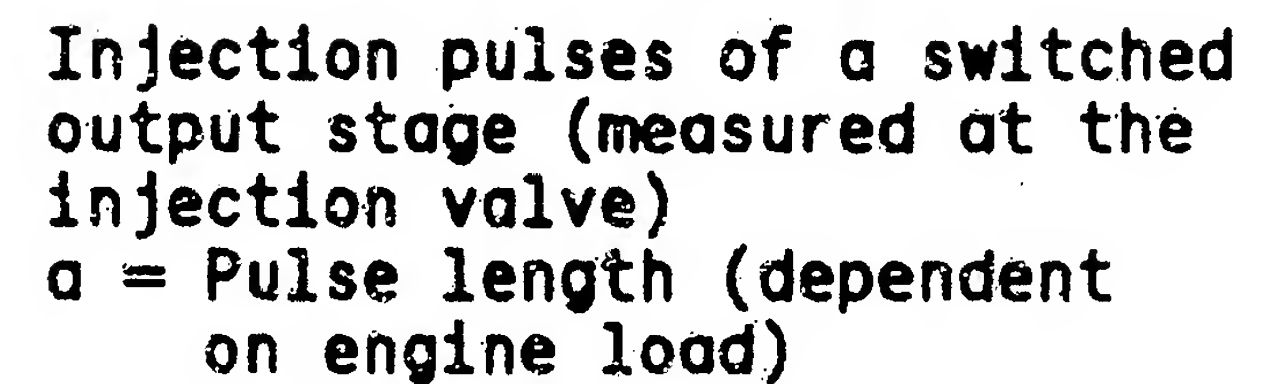
Set value:
With decreasing engine speed,
injection signals cut in again
above the idle speed.

Is set value attained?

Make sure that the idle switch has been correctly adjusted and is in proper working order.

If this is the case => replace control unit.

If this is the case =>
replace control unit.



Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

After testing is finished:

Ignition "OFF". Disconnect
motortester. Disconnect
test lead from solenoid-
operated injection valve and
connect connector.

Ignition "OFF". Disconnect
motortester. Disconnect
test lead from solenoid-
operated injection valve and
connect connector.

Return to trouble-shooting chart
303

TROUBLE-SHOOTING PROGRAM (9)

V

Check exhaust-gas cat. converter.

Engine at operating temperature.

Separate lambda-sensor plug
(control) and measure CO concen-
tration downstream of cat. con-
verter. Make a note of the value.

Unscrew lambda sensor and measure
CO concentration upstream of
cat. converter in sensor hole.
Use own-fabrication adapter
for exhaust-gas sampling
(thread M 18 x 1.5).
Make a note of the value.

Set value: CO concentration down-
stream of catalytic converter
must be considerably lower.

Set value obtained?

Y

V

Remove adapter and screw in lambda
sensor.

Fit sensor plug together (closed-
loop control).

Y

V

Return to trouble-shooting chart
B03

N>

If both values are almost the
same, the catalytic converter is
clogged (leaded fuel has been
used) and must be replaced.

TROUBLE-SHOOTING PROGRAM (10)

Check interference and missing.

Connect the two-pole test lead 1 684 463 093 between an injection valve and its connector.

Connect motortester (special input) to test lead. Black clamp to vehicle ground. Connect red clamp to one of the two connections of the test lead.

Caution: the free terminal of the test lead must not come into contact with ground.

Let engine run.

If correctly connected, injection pulses will be visible on the oscilloscope (diagram opposite).

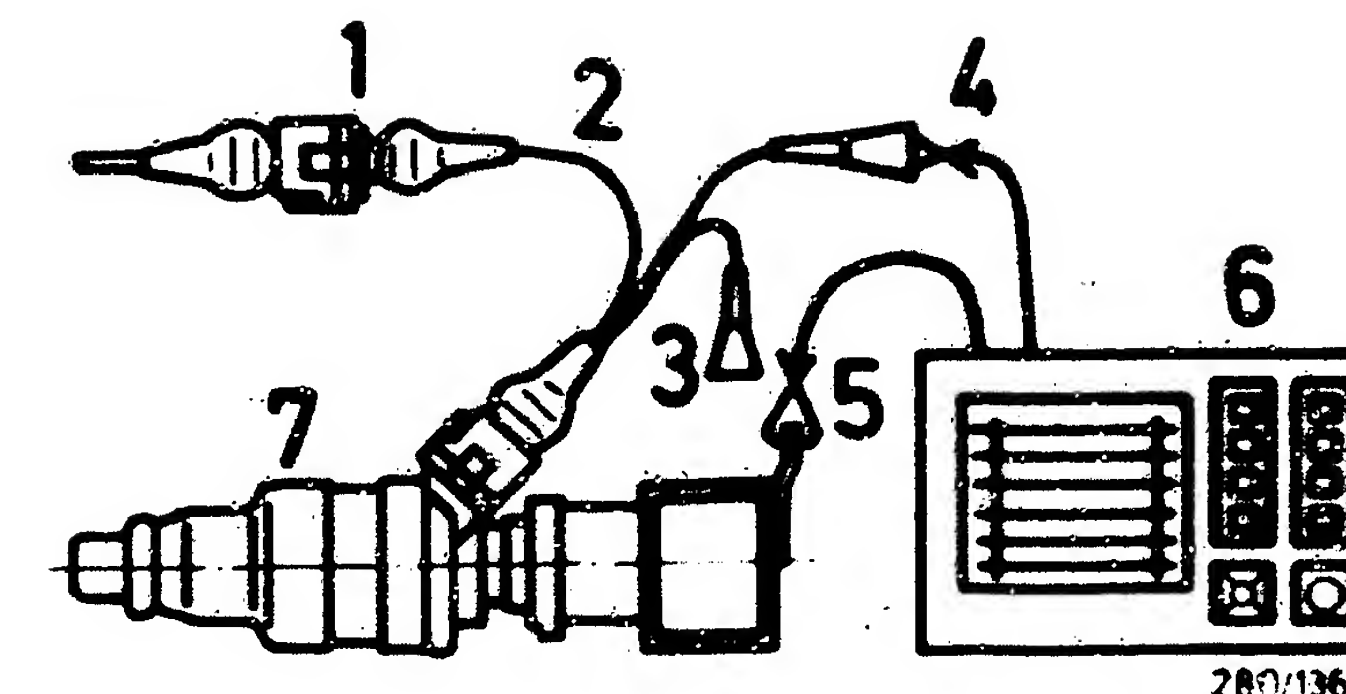
Set value: injection pulses

Set value obtained?

N>

Check connections.
Connect the red clamp from the motortester to the other connection of the test lead.

The free connection must not come into contact with ground.

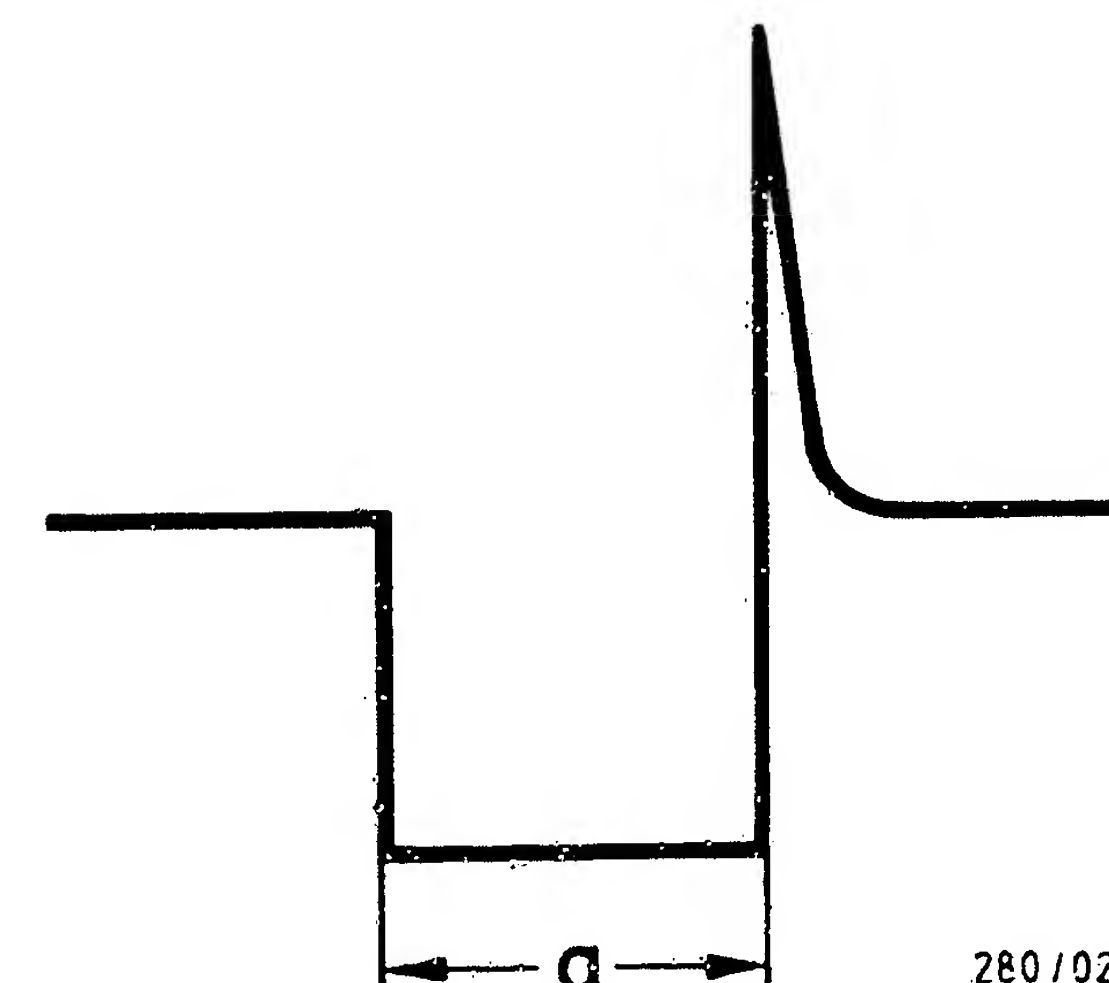


- 1 = Connector
- 2 = Test lead 1 684 463 093
- 3 = Free connection
- 4 = Red clamp
- 5 = Black clamp
- 6 = Motortester
- 7 = Injection valve

Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

Continued on next picture page

Continued on next picture page



TROUBLE-SHOOTING PROGRAM (10) CONTINUED (1)

After testing is finished:

Ignition "OFF". Disconnect
motortester. Disconnect
test lead from solenoid-
operated injection valve and
connect connector.

With engine off, remove plug
from alternator.
Start engine.
If missing stops, check
alternator and regulator.
Voltage peaks are visible
on the ignition oscilloscope.

Return to trouble-shooting chart
B03

H27

<==>

H28

<==>

TROUBLE-SHOOTING PROGRAM (11)

Increased noise from electric fuel pump.

N>

In case of:

- high outside temperatures,
 - high fuel temperatures,
 - fuel tank almost empty,
 - lengthy full-load driving or
 - at idle,
 - use of winter fuel at warmish outside temperatures,
- vapor locks in the intake line may lead to noises at the electric fuel pump.

Are pump noises normal?

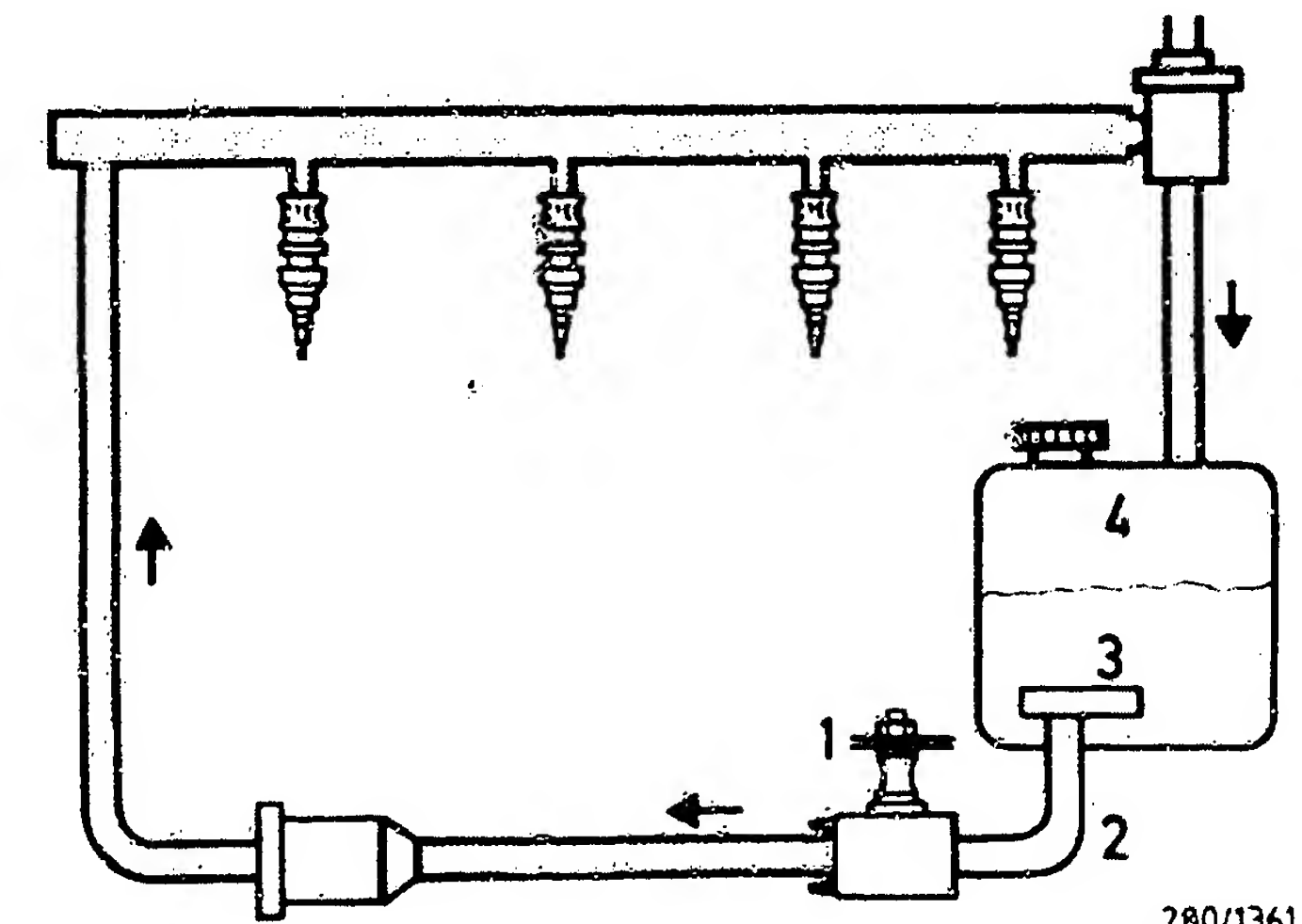
*Pump suspension (vibration damper) defective -> replace.

*Intake line constricted or kinked -> replace.

*Strainer in fuel tank clogged -> replace.

*Intake or delivery line transmitting pump noises to vehicle body -> lay lines so that they are free of tension, or replace if necessary.

*If fuel tank almost empty -> fill up.



- 1 = Pump mounting
- 2 = Intake line
- 3 = Intake strainer
- 4 = Fuel level

Return to trouble-shooting chart B03

J01

<=>

J02

<=>

INDEX

Term	Coordinate
Catalytic converter	H23
Check-engine lamp	B07
Combustion miss	H25
Delivery	H01
Diagnosis unit	B07
Electric fuel pump	H01
Flashing code	B11
Freedom from leaks - air intake system	G25
- fuel system	H03
- injection valves	H05
Fuel delivery	H01
Fuel filter	H03
Fuel leakage	H05
Fuel lines	H03
Fuel pressure	H03
Heater for lambda sensor	C19
Hot-wire air-mass meter	C03
How to use - trouble-shooting chart	B01
- trouble-shooting program	B07
- microcard	A07
Indicator lamp (LED)	B07
Injection pulse	H19
Installation position of components	A11
Interference	H25
Main relay	C15
Pressure damper	H03
Pressure regulator	H03
Self-cleaning	F25
Self-diagnosis	B07
Solenoid-operated injection valve	B25
Special features	A03
Throttle-valve adjustment	C17
Throttle-valve switch - idle	C17
- full load	C21
Trouble-shooting chart	B03
Trouble-shooting program	B23

Index, continued

Term	Coordinate
Actuator diagnosis	B07
Air intake system	G23
Control unit	B23
Full-load contact	C21
Idle - regulation	E05
- actuator	E05
Idle contact	C17
Ignition signal	C13
Intake-manifold-pressure actuation	H05
Lambda closed-loop control	C23
Lambda sensor	C19
Overrun cutoff	H19
Pre-supply pump	G01
Precautionary measures	A07
Pump noise	J01
Pump relay	J01
Safety measures	A07
Start control	H17
Switch - A/C standby	G05
- A/C compressor	G07
Switching-input diagnosis	B07
Tank ventilation - system	H11
- valve	H13
Temperature sensor (engine)	C09
Test chart - self-diagnosis	B13
- switching-input diagnosis	B19
- actuator diagnosis	B21
Test prerequisites	B01
Testers	A09
Tools	A09
Voltage supply	G23

TABLE OF CONTENTS

Section	Coordinates
Structure of this microcard.....	A01
How to use this microcard.....	A02
Special features.....	A03
Safety and precautionary measures.....	A07
Testers and tools.....	A09
Installation position of components.....	A11
How to use trouble-shooting chart and trouble-shooting program.....	B01
Trouble-shooting chart.....	B03
How to use self-diagnosis, self-diagnosis test table and trouble-shooting program.....	B05
Activation of self-diagnosis.....	B09
Activation of switching-input diagnosis.....	B07
Activation of actuator diagnosis.....	B07
Self-diagnosis test table.....	B13
Switching-input and actuator-diagnosis test table.....	B19
Self-diagnosis - trouble-shooting program.....	B05
Switching-input diagnosis - trouble- shooting program.....	B19
Actuator diagnosis - trouble-shooting program.....	B21
Trouble-shooting program.....	B23
Technical bulletins.....	—
Index.....	B25

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